Bathurst Regional Council

Chifley Dam Pipeline Routes Terrestrial Flora and Fauna Study

March 2013

Table of contents

Table index

Figure index

Appendices

Executive Summary

Bathurst Regional Council has engaged GHD Pty Ltd to undertake a Terrestrial Flora and Fauna Study (TFFS) to assess the ecological constraints and potential impacts of two possible pipeline routes connecting Chifley Dam to the Bathurst Water Filtration Plant. The Study Area is located between the Water Filtration Plant in Gormans Hill, east of Bathurst, and Chifley Dam to the south.

The aims of the TFFS were to identify ecological constraints along the two route options and undertake a preliminary impact assessment to assess potential impacts of the routes on biodiversity values, in particular threatened biota listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and ecological matters of national environmental significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities and migratory species that occur in the locality and have the potential to be impacted by the pipeline routes. Biodiversity databases and literature pertaining to the study area and locality were reviewed.

Field surveys were undertaken by two senior ecologists from 5 to 9 November 2012 along the two proposed routes for the pipeline. Surveys targeted areas of native vegetation, including areas of woodland and riparian vegetation (alongside dams, lagoons, minor creeks and the river) in order to identify the biodiversity values and therefore the ecological constraints of each route. Survey methods included vegetation quadrats and transects, fauna habitat assessment, hollow-bearing tree assessments, diurnal bird surveys, spotlighting, call playback and bat echolocation call analysis.

A total of 114 species of flora were recorded within the study area, comprising 45 native species and 69 exotic species. No threatened plants were recorded within the study area. The relatively low diversity of native plant species recorded reflects the extensive disturbance and modification of the study area for agricultural activities.

Six vegetation types were identified in the study area, of which four are native, one is planted, and one is exotic:

- Blakeley's Red Gum – Yellow Box woodland.
- Apple Box – Yellow Box woodland.
- Planted Blakely's Red Gum – Yellow Box woodland.
- River Oak riparian forest.
- Freshwater Wetland.
- Exotic grassland.

Native vegetation occurs as isolated remnant or regrowth patches, surrounded by existing disturbance including cleared grazing land, cropland, water storages, roads and other infrastructure. The three box-gum woodland types meet the criteria for the NSW TSC Act definition of the endangered ecological community (EEC) "White Box- Yellow Box- Blakely's Red Gum Woodland" (Box-gum woodland). The Box-gum woodland does not qualify as the EPBC Act listed critically endangered ecological community (CEEC) "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland".

Up to 132 fauna species were recorded during the field surveys. This included 100 bird species, eight terrestrial and arboreal mammal species, up to 10 bat species, seven reptile species and seven frog species. Eight introduced species were recorded, including five bird species and three mammal species.

Seven threatened fauna species were definitely recorded during surveys. These included:

- Diamond Firetails (*Stagonopleura guttata*), listed as vulnerable under the TSC Act.
- A Spotted Harrier (*Circus assimilis*), listed as vulnerable under the TSC Act.
- A Little Eagle (*Hieraaetus morphnoides*), listed as vulnerable under the TSC Act.
- A pair of Australian Painted Snipe (*Rostratula australis*), listed as endangered under the TSC Act and vulnerable and migratory under the EPBC Act.
- A Booroolong Frog (*Litoria booroolongensis*), listed endangered under the TSC Act and the EPBC Act.
- A Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the TSC Act and the EPBC Act.
- The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), listed as vulnerable under the TSC Act.

Three threatened microbats were recorded as 'probable' based on recorded echolocation analysis (see Figure 4). These included:

- The Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Large-footed Myotis (*Myotis macropus*), and Eastern Cave Bat (*Vespadelus troughtoni*) listed as vulnerable under the TSC Act.

Three migratory species listed under the EPBC Act were recorded:

- The Australian Painted Snipe (*Rostratula australis*), Latham's Snipe (*Gallinago hardwickii*), and Rainbow Bee-eater (*Merops ornatus*).

The main potential impacts of the proposal relate to the clearing of native vegetation, in particular the EEC White Box- Yellow Box- Blakely's Red Gum Woodland and related habitat for threatened species, and disturbance of habitat for the endangered Booroolong Frog. A comparison of vegetation clearing for each of the pipeline routes was undertaken, and fed into the constraints assessment for the two main routes. Based on the constraints assessment, Route 2 is likely to result in less impact on biodiversity values, including habitat for threatened biota. Route 2 is preferred due to the lower area of native and threatened vegetation that would be impacted, and the potential to better avoid impacts on native vegetation and hollow-bearing trees by going around vegetation patches or using existing easements and access tracks.

Preliminary impact assessments were prepared for key threatened biota. The method of crossing Campbells River (both routes) may significantly impact the Booroolong Frog if the pipeline is trenched rather than directionally drilled. A Species Impact Statement and an EPBC Act referral would be required if the proposal is likely to have a significant impact on the Booroolong Frog. The Booroolong Frog is unlikely to be significantly impacted if the directional drilling method is used. The project is unlikely to significantly impact any other threatened fauna species, however the significance of impacts for all threatened biota likely to be impacted would need to be reassessed once a preferred route is finalised in order to take into account final design elements.

Some areas of sensitive threatened fauna habitat are present, in particular the rocky riverbanks where the endangered Booroolong Frog was recorded or could occur, the freshwater wetland at The Lagoon, where the Australian Painted Snipe and Latham's Snipe were recorded, and

patches of the endangered Box-gum Woodland. A range of possible options for monitoring impacts on these habitats and threatened biota during construction have been presented. Mitigation measures are recommended in this study to minimise impacts on biodiversity values and habitat for threatened biota (including in the sensitive areas discussed above).

1. Introduction

1.1 Background

Bathurst Regional Council (Council) engaged GHD Pty Ltd (GHD) to undertake a Terrestrial Flora and Fauna Study (TFFS) to assess the ecological constraints and potential impacts of two possible pipeline routes connecting Chifley Dam to the Bathurst Water Filtration Plant (WFP).

Further studies relating to the project (such as an aquatic flora and fauna study) will be undertaken at a future date. All studies will be used to determine the optimum route for the pipeline, which would be based on a combination of ecological constraints, engineering constraints, property constraints, and so on. The preferred route would then require assessment under the NSW *Environmental Assessment and Planning Act 1979* (EP&A Act). The Part under which the proposal is assessed would be determined once the final route is decided.

1.2 Location of the proposed routes

The study area is located mainly to the south of Bathurst, with the northernmost part of the study area being the WFP in east Bathurst (Figure 1). Two pipeline route options are being investigated, with a third option relating to the initial section of Route 1:

- Route 1 follows the road reserve south from the WFP, first along Gormans Hill Road, then along Lagoon Road to south of The Lagoon, before heading through private property to Chifley Dam.
- Route 2 follows a route through generally cleared agricultural land closer to the Macquarie River.
- Route 3 is a short option leading from the WFP through private properties for a short distance before joining Route 1 on Gormans Hill Road. Given that the ecological constraints of this route are little different from Route 1, this route is not assessed separately from Route 1.

The study area is located mainly in the Bathurst local government area (LGA), with a small area near Chifley Dam within the Oberon LGA. It is within the Bathurst subregion of the Central West Catchment Management Area (CMA). The study area is also located within the South Eastern Highlands Bioregion.

1.3 Purpose of this report

This TFFS aims to:

- Identify a representative sample of terrestrial flora and fauna species and ecological communities within the Project Area that have the potential to be impacted on by the proposed pipeline routes.
- Identify threatened flora and fauna species and populations, migratory species and Endangered Ecological Communities (EECs) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and NSW *Threatened Species Conservation Act 1995* (TSC Act) that exist within the study area, including those identified in the Pre-feasibility Assessment prepared by HTC (2008).
- Identify potential significant impacts of the proposal on any listed threatened species or EECs.

- Outline the appropriateness of each route for pipeline placement given the presence or absence of individual species, populations or communities as listed under the EPBC Act and TSC Act.
- Develop options in order to mitigate any identified potential significant impacts.
- Address the recommendations made in the Pre-feasibility Assessment (HTC 2008).

1.4 Definitions

The following terms are used in this report:

- Locality – within a 10 km radius of the study area.
- Study area – the general area between Chifley Dam and the Water Treatment Plant.
- Pipeline corridor – the pipeline routes and a buffer of 100 m either side of the pipeline centrelines.

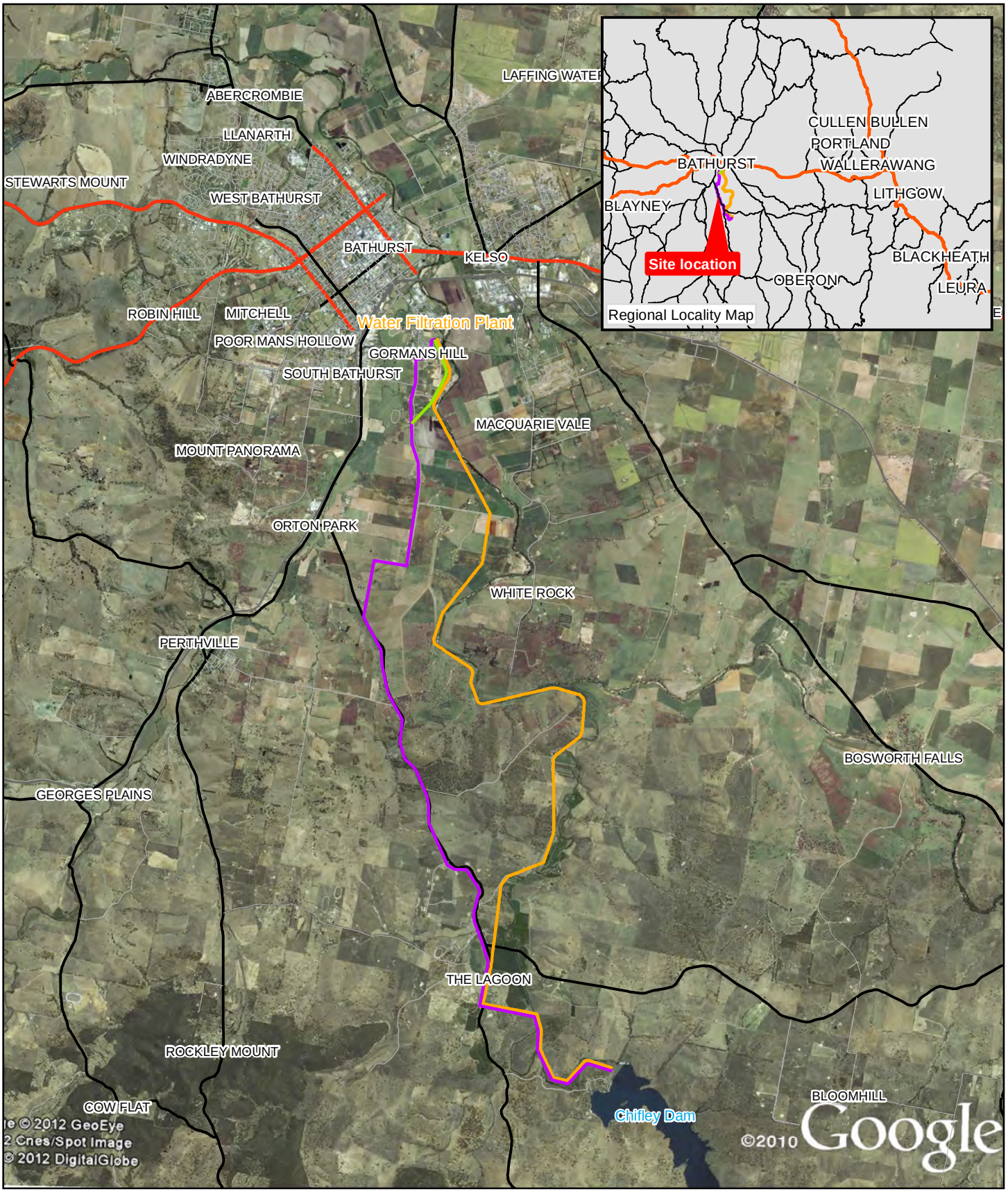
1.5 Scope and limitations

This report: has been prepared by GHD for Bathurst Regional Council and may only be used and relied on by Bathurst Regional Council for the purpose agreed between GHD and Bathurst Regional Council as set out in section 1.3 of this report. GHD otherwise disclaims responsibility to any person other than Bathurst Regional Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.3 and 5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Bathurst Regional Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Investigations undertaken in respect of this report are constrained by the particular site conditions and access constraints. As a result, not all relevant site features and conditions may have been identified in this report. Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Railway

1:101,563(at A4)

0 400 800 1,600 2,400 3,200

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Job Number	21-21844
Revision	2
Date	13 Mar 2013

Locality of the study area

Figure 1

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z006_TheLocality.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed, November 2012. Created by: swoodger

2. Legislative Context

This chapter provides details on the main State and Commonwealth acts and policies that would be relevant to the proposal.

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to, inter alia, 'encourage the proper management, proposal and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000. Once a final route is decided, the project would need to be assessed in accordance with the Act.

Section 111(4) of the Act states that the determining authority must consider the effect of an activity on:

- 'Critical habitat' (as defined under the TSC Act and FM Act).
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a 'significant effect' on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

This report addresses the ecological components of the 'environment' to assist Council with their consideration of s.111 of the Act to assist in determining the preferred route option.

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act. The assessment of significance is used to assist in the determination of whether a proposal is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required.

This TFFS assesses the likelihood of threatened biota listed under the TSC Act occurring in the study area and their potential to be impacted by the two routes. Preliminary assessments of significance for relevant biota are included in Appendix D. These preliminary assessments of significance are provided to help with deciding on a preferred route option, and would need to be re-assessed as part of the impact assessment of the preferred route.

2.1.2 Threatened Species Conservation Act 1995

The TSC Act provides legal status for biota of conservation significance in NSW. The Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2.
- The listing of 'Key Threatening Processes' (under Schedule 3).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.

- Requirements or otherwise for the preparation of a Species Impact Statement (SIS).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site and hence could occur subject to the habitats present.
- Targeted field surveys for threatened species listed under the Act.
- Identification, assessment and mapping of EECs listed under the Act.
- Preliminary assessment of potential impacts on key threatened biota relevant to this study.

2.2 Commonwealth legislation

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on matters of national environmental significance (MNES) undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the 'Minister').

The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- Nuclear actions (including uranium mining).
- Great Barrier Reef Marine Park.

Potential impacts on any MNES must be subject to assessments of significance pursuant to the EPBC Act Significant Impact Guidelines (DEWHA 2009). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Commonwealth Environment Minister.

This TFFS assesses the likelihood of MNES occurring in the study area and their potential to be impacted by the two routes. Preliminary assessments of significance for key MNES are included in Appendix D. These preliminary assessments of significance are provided to help with deciding on a preferred route option, and would need to be re-assessed as part of the impact assessment of the preferred route.

2.3 State planning policies

2.3.1 SEPP 44: Koala Habitat

State Environmental Planning Policy 44 (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'. The application of SEPP 44 to the proposal may depend on which Part of the EP&A Act the proposal is assessed under. The principles of SEPP 44 are adopted here as guide to the assessment of Koala populations and their habitats. The Koala is listed as a vulnerable species under the TSC Act and EPBC Act, and thus also requires assessment under these Acts.

Schedule 1 of SEPP No. 44 identifies local government areas (LGAs) to which SEPP 44 applies. The site is within the Bathurst LGA which is listed under Schedule 1. SEPP 44 requires that before granting consent for development on land over 1 hectare in area, a consent authority must be satisfied as to whether or not the land is 'potential' and 'core' koala habitat. Potential koala habitat is defined as 'an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component'. Core koala habitat is defined as 'an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management (KPoM) be prepared, unless a LGA-based KPoM exists. Bathurst Regional Council has not prepared a comprehensive KPoM for the LGA, however site-specific plans have been prepared.

The study area is dominated by secondary Koala food trees identified for this region in the Koala Recovery Plan (DECC 2008a). Some primary feed trees are present in the southern portion of the study area. The majority of records of the Koala in the locality are from the Rockley Mount area to the west of the study area. Koalas have been sighted on occasion in the Bidgeribbin Road area of the study area.

An assessment of potential and core Koala habitat was undertaken and preliminary assessments of impacts of the two options on the Koala have been considered in this report. Further survey and assessment would be required once the final route is decided on.

3. Methodology

This chapter provides details of the methods used to assess the biodiversity values of the study area, including desktop review and field surveys. The methods used to determine the likelihood of occurrence of threatened and migratory biota are also provided. Survey conditions and limitations are discussed.

3.1 Database and literature review

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities listed under the TSC Act and MNES listed under the EPBC Act that occur in the locality and have the potential to be impacted by the various pipeline routes. Biodiversity databases and literature pertaining to the study area and locality (i.e. within a 10 km radius of the study area) were reviewed and included:

- Office of Environment and Heritage (OEH) Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality (OEH 2012a, dated 23 August 2012).
- OEH threatened species profiles online database (OEH 2012b), including records of endangered populations and communities recorded within the Bathurst CMA subregion.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool for MNES listed under the EPBC Act within the locality (DSEWPaC 2012a, dated 26 October 2012).
- DSEWPaC online species profiles and threats database (DSEWPaC 2012b).
- Birdlife Australia records of threatened and migratory birds for the locality (data provided September 2012).
- Bathurst Regional Council's database of threatened biota and vegetation communities (data provided in October 2012).
- *Ben Chifley Dam to Bathurst Water Treatment Plant Pipeline Pre-feasibility Assessment* (HTC, 2008).
- *Reconstructed and Extant Distribution of Native Vegetation in the Central West Catchment* (DEC, 2006).

3.2 Field surveys

Surveys were undertaken by two senior ecologists from 5 to 9 November 2012 along the two proposed routes for the pipeline, with surveys focussed on a 200 m wide corridor of each route (ie. 100 m either side of the approximate centreline). Surveys targeted areas of native vegetation, including areas of woodland and riparian vegetation (alongside dams, lagoons, minor creeks and the river) in order to identify the biodiversity values and therefore the ecological constraints of each route. Data sheets were used for entry of field data (including survey sites) and to compile an inventory of flora and fauna species. Handheld GPS and Trimble units were used to record locations of survey sites, and any threatened species or particular habitat features. The survey methodology for flora and fauna is detailed below. Locations of survey sites are provided in Figure 2a and b.

3.2.1 Flora survey methodology

Vegetation Mapping

Native vegetation within the study area was mapped based on observed species composition and vegetation structure according to the classification of Specht (1970). Intact native vegetation communities were defined according to DEC (2006) broad vegetation types (BVTs) for the Central West catchment. Vegetation was mapped based on dominant species within the canopy, mid- and ground layers. Exotic or planted native vegetation was defined based on structure and species composition. Fine-scale ground-truthing of previous vegetation mapping and validation of the location of threatened ecological communities and threatened species habitat was performed with reference to a Trimble hand-held GPS unit loaded with aerial photography and DEC (2006) vegetation mapping. Vegetation types were mapped at a fine scale within the study areas using aerial photographic interpretation within a geographical information system (GIS) as guided by the field survey results.

Vegetation types with the potential to be threatened ecological communities (including areas of conservation significance that were identified in the Pre-feasibility Assessment) were verified through vegetation sampling quadrats as described below.

Flora Sampling

Vegetation was sampled with 400 m^2 quadrats placed systematically within vegetation types as specified in the DEC (2004) survey guidelines. A total of 11 quadrats were sampled within the study area as shown on Figure 2a and b. Many patches of vegetation in the study areas are narrow, linear remnants and so these were sampled with 40 m x 10 m quadrats rather than the standard 20 m x 20 m arrangement.

Plant identifications were made according to nomenclature in PlantNet (RBGT, 2012). All vascular plants (i.e. not mosses, lichens or fungi) observed were recorded on pro forma field data sheets. Plant specimens that could not be identified rapidly in the field were collected and subsequently identified using standard botanical texts and/or PlantNet (RBGT, 2012). Plant specimens which were unable to be identified because diagnostic materials such as fruiting bodies were not available at the time of the survey were identified to genus level. Plant species were given a cover abundance rating within each quadrat.

Additional biophysical data was recorded for each quadrat including: height and cover of vegetation layers; geomorphic setting; native regeneration; degree of weed infestation; and evidence of disturbance such as grazing. This combination of plant species composition, vegetation structure, geomorphic setting and condition was compared with identification guidelines for threatened ecological communities. The condition of vegetation attributes was scored with reference to GHD ecologists' experience of similar, undisturbed vegetation types and comparison with benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement. Benchmark values for vegetation types in the study area are listed in the OEH (2012) Vegetation Benchmarks Database. Values for these vegetation attributes are quoted in Section 4.3.2 to describe the condition of vegetation types in the study area.

A flora species list was compiled for each vegetation type and for the study area noting the occurrence of noxious and environmental weeds, threatened species and regionally significant species.

Targeted threatened flora surveys

Targeted surveys were undertaken for threatened flora species which could potentially occur within the study area given known distributions, previous records in the locality and habitat requirements for each species. Surveys were conducted on foot while ground-truthing vegetation mapping and while travelling between quadrats. Not every area of potential threatened plant habitat within the study areas was systematically searched. Additional random meander transects focused in areas of potentially suitable habitat may be appropriate in later stages of the study.

3.2.2 Fauna survey methodology

Habitat assessment

Habitat assessments were conducted along the route corridors to help describe the suite of native fauna likely to occur in the study area. Particular attention was paid to the identification of habitat features and resources considered diagnostic of threatened species.

Habitat assessments included searches for and inspection of:

- Quality of substrate for sheltering frogs and reptiles including rocks, logs, peeling bark, leaf litter and native grassland.
- Presence of winter-flowering eucalypts, important for Swift Parrot (*Lathamus dicolor*), Regent Honeyeater (*Anthochaera phrygia*) as feed trees.
- Presence of primary, secondary or supplementary Koala (*Phascolarctos cinereus*) feed trees (DECC 2008b).
- Hollow-bearing trees and logs.
- Stags and other roost sites for raptors and owls.
- Presence of surface rock indicating potential habitat for the Pink-tailed Worm-lizard (*Aprasia parapulchella*).
- Vegetation patch size, age, disturbance and structural diversity (important for many threatened birds).
- Wetlands, moist grassland and other foraging habitat for waterbirds (including migratory birds) and frogs.
- Mammal scats at the base of trees or along tracks and runways.
- Tracks in soft substrate.
- Nest/den sites within logs, tree bases or tree trunks.
- Nests, shell middens, scats and whitewash in the vicinity of aquatic habitats (diagnostic of semi-aquatic mammals and waterbirds).
- Guano or moth remains at the base of hollow-bearing trees (diagnostic of the presence of tree-roosting bats).
- Scratches on tree trunks (diagnostic of Koalas, gliders or goannas) and worn bark around tree hollows (diagnostic of active use of hollows).
- Owl pellets, whitewash or animal remains beneath trees (diagnostic of owl or raptor roosts).

Locations of important habitat features were captured with a handheld GPS unit.

Hollow-bearing tree transects

Transect surveys of hollow-bearing trees (HBTs) were undertaken in woodlands and areas of scattered trees to determine density of hollow-bearing trees in various habitat types. Data collected included tree species, height, diameter at breast height (DBH), and number, size and location of hollows. Locations of survey sites are provided in Figure 2a and b.

Koala searches

Koala searches were undertaken in conjunction with hollow-bearing tree transects (see Figure 2a and b). Trees were inspected for Koalas and scratches, and bases of trees were searched for scats. Scat searches were also undertaken opportunistically during habitat assessments.

Diurnal bird surveys

Diurnal bird surveys were performed at dawn and dusk, targeting representative habitats within each route corridor,including larger woodland patches, riparian areas, swamps, and open paddocks. Area searches of at least 20 minutes were undertaken to compile a list of native birds present in each habitat type. Species were identified by sight and call. Locations of survey sites are provided in Figure 2a and b. Incidental observations of birds outside the targeted survey period were also recorded.

Diurnal reptile surveys

Active searches for reptiles were conducted throughout the habitat assessment and during hollow-bearing tree transects and Koala spot assessments. Diurnal surveys included rock-turning in areas of rock outcrop, and inspection of leaf litter, fallen timber and rubbish (eg metal sheeting) for reptiles.

Anabat recordings

Microbat ultrasonic echolocation call recordings (Anabat surveys) were performed. Fixed recordings were undertaken from dusk until the following morning at two locations on each of four nights. Units were placed in areas likely to be utilised by foraging bats, for example woodland, riparian areas, near swamps and open paddocks. Locations of survey sites are provided in Figure 2a and b.

Microbat calls collected during the field surveys were identified using zero-crossing analysis and AnalookW software by visually comparing call traits (version 3.8m, Chris Corben 2010). The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay et al 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2012). No reference calls were collected during the survey as harp-trapping was not undertaken and therefore no bats were captured.

A call (pass) was defined as a sequence of four or more consecutive pulses of similar frequency. Calls with less than four defined pulses were excluded from the analysis. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000). Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Species nomenclature follows Pennay *et al* (2011), then van Dyck and Strahan (2008).

Call playback

Nocturnal call playback surveys were undertaken on three nights in areas of suitable habitat for the Barking Owl (*Ninox connivens*), the Koala and Squirrel Gliders (*Petaurus norfolcensis*). The surveys involved quiet listening, followed by short broadcasts of calls, followed by quiet listening and spotlighting. Locations of survey sites are provided in Figure 2a and b.

Call playback for the Booroolong Frog (*Litoria booroolongensis*) was undertaken at sites along the Macquarie and Campbells Rivers where areas of cobbles and pebbles were present. Call playback for the Green and Golden Bell Frog (*Litoria aurea*) was undertaken at sites along the Macquarie and Campbells River and at The Lagoon where emergent vegetation was present. Frogs were also identified by call along the rivers and at various farm dams throughout the study area. Locations of survey sites are provided in Figure 2a and b.

Spotlighting

Spotlighting was undertaken each night, focussing on areas of woodland, to target nocturnal birds and mammals, and riparian and swamp areas, to target frogs. Spotlighting was undertaken on foot, using Led Lenser torches. On one evening, a dusk survey for the Platypus (*Ornithorhynchus anatinus*) was undertaken at a location on the Macquarie River where Platypus had regularly been observed by the landowner, and involved watching the surface of the water for Platypus or ripples indicative of Platypus swimming near the surface. Spotlighting was also used to search for Platypus once it was dark. Locations of survey sites are provided in Figure 2a and b.

Incidental observations and community information

Any incidental sightings of fauna or fauna calls were also recorded. A number of local community members also offered anecdotal information on the presence of fauna species (in particular the Koala and Platypus).

3.3 Likelihood of occurrence

Following collation of database records and species and community profiles a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the study area. This was further refined following field surveys. The likelihood of threatened and migratory biota occurring in the study area was assessed based on the presence of records from the locality, species distribution and habitat preferences, quality of potential habitat present in the study area, and time since the species was last recorded in the locality. The results of this assessment are provided in Appendix A.

Table 1 provides a key to the likelihood of occurrence in the study area of threatened biota known or likely to occur in the locality.

Table 1 Key to Likelihood of Occurrence for Threatened Species

Likelihood	Definition
Present	Recorded in the study area in the current survey.
Likely	Species previously recorded within a 10 kilometre radius of the study area and suitable habitat occurs within the study area.
Possible	Species previously recorded within a 10 kilometre radius of the study area but only marginal suitable habitat recorded, OR Species not previously recorded within a 10 kilometre radius of the study area, but the study area is within the species known distribution and suitable habitat occurs within the study area.
Unlikely	Species previously recorded within a 10 kilometre radius of the study area but no suitable habitat recorded.

Likelihood	Definition
	Species with potential habitat within the study area, but no records in the last 30 years.
Nil	Species not previously recorded within a 10 kilometre radius of the study area, suitable habitat not recorded within subject, and/or study area outside species known distribution.

3.4 Survey conditions and limitations

Results of field surveys depended on weather conditions at the time of surveys, as well as timing and duration of surveys, and access constraints. These are detailed below.

3.4.1 Survey conditions

Weather conditions were variable during the survey, with some hot, sunny days, and some days with rain. There was heavy rain in the late afternoon and early evening on Wednesday 7 November, however rain cleared by early morning on the Thursday 8 November. A summary of weather conditions at the nearby Bathurst Airport is provided in Table 2. There was occasional noise from passing traffic along the road route (Route 1).

Table 2 Weather conditions during surveys

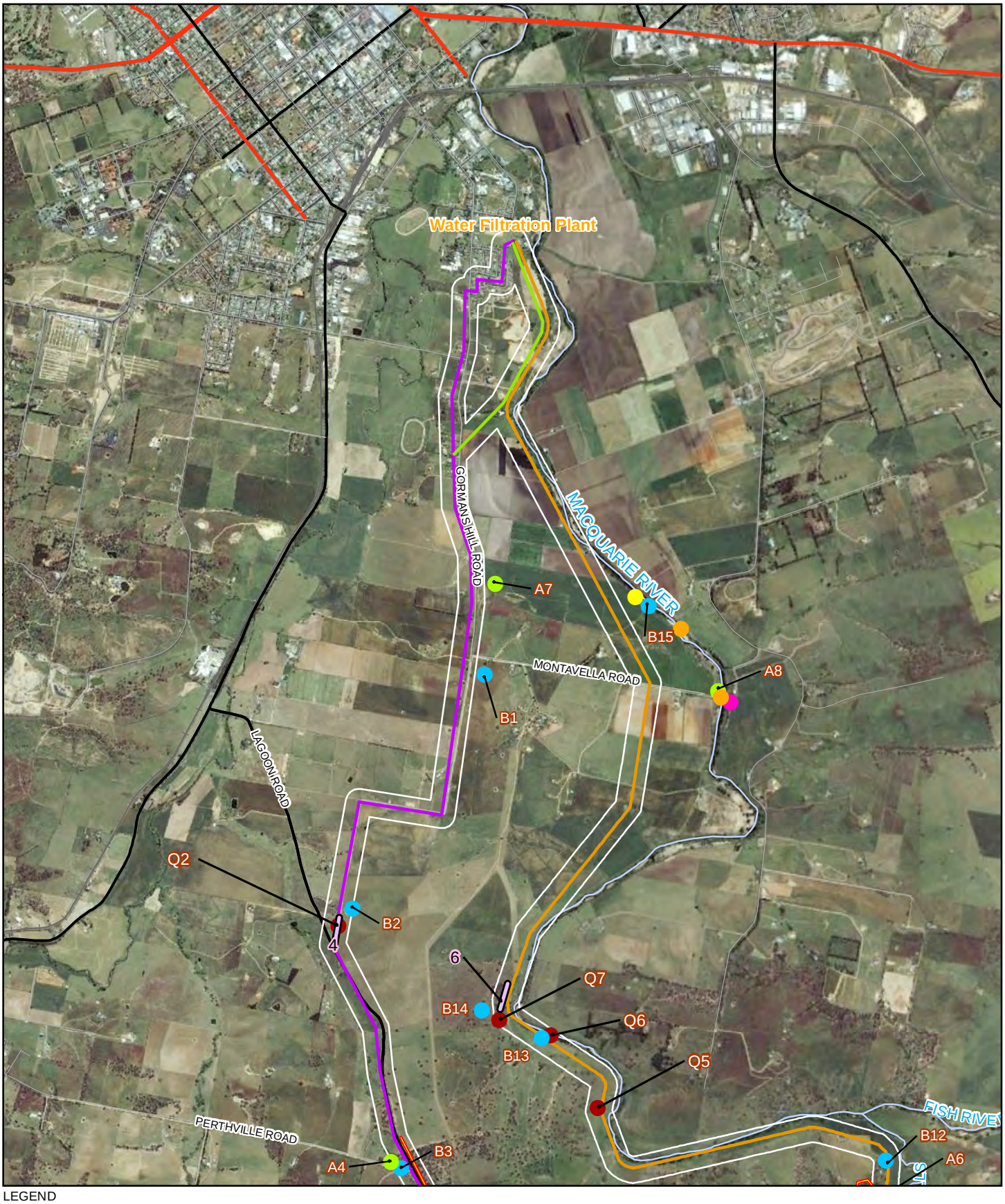
Date	Temperature		Rain	Relative Humidity (at 9am)	Wind (at 9 am)		Relative Humidity (at 9am)	Wind (at 9 am)	
	Min	Max			Dir	Spd	RH	Dir	Spd
	°C	°C	mm	%		km/h	%		km/h
November 5 2012	6.9	29.6	0	63	NNE	9	39	NNE	11
November 6 2012	13	29	0	53	NNW	13	41	WNW	28
November 7 2012	15.4	22.4	1	92	N	6	61	N	19
November 8 2012	13.5	24.7	4.4	84	N	13	49	SW	22
November 9 2012	11.1	23.6	0.2	84	WNW	19	44	WSW	28

3.4.2 Survey limitations

Given that this study is preliminary in nature, not all land was accessed for the surveys. Where possible, surveys were focussed on areas of native vegetation, however not every patch of native vegetation was assessed in the field.

Given the duration and timing of the field survey it is likely that some species that utilise the study area (permanently, seasonally or transiently) were not detected during the survey. These species may include flora species that are annual or cryptic species. Some fauna species are also mobile and transient in their use of resources, and some are seasonal migrants, and it is likely that not all species that potentially occur in the study area were recorded during the survey period. Surveys were, however, conducted in generally warm weather in spring, and it is likely that a good proportion of species present or likely to occur were recorded. There was some rain during the survey which may have interfered with detection of some fauna (particularly during spotlighting), but would have assisted with frog surveys. Frogs were heard calling during the night and day throughout the survey.

The habitat assessment conducted for the site allows for identification of habitat resources for species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values present in the study area in order to predict potential impacts of the pipeline routes, with particular emphasis on threatened ecological communities and threatened and migratory species and their habitats that are known or likely to occur.



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- HBTTransect
- Spotlighting
- Anabat
- Bird survey
- Call playback
- Platypus survey
- Frog survey
- Flora quadrats
- Highways
- Major Roads
- Secondary Roads
- Other Roads

1:40,000 (at A4)

0 250 500 1,000 1,500

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Job Number 21-21844

Revision 2

Date 13 Mar 2013

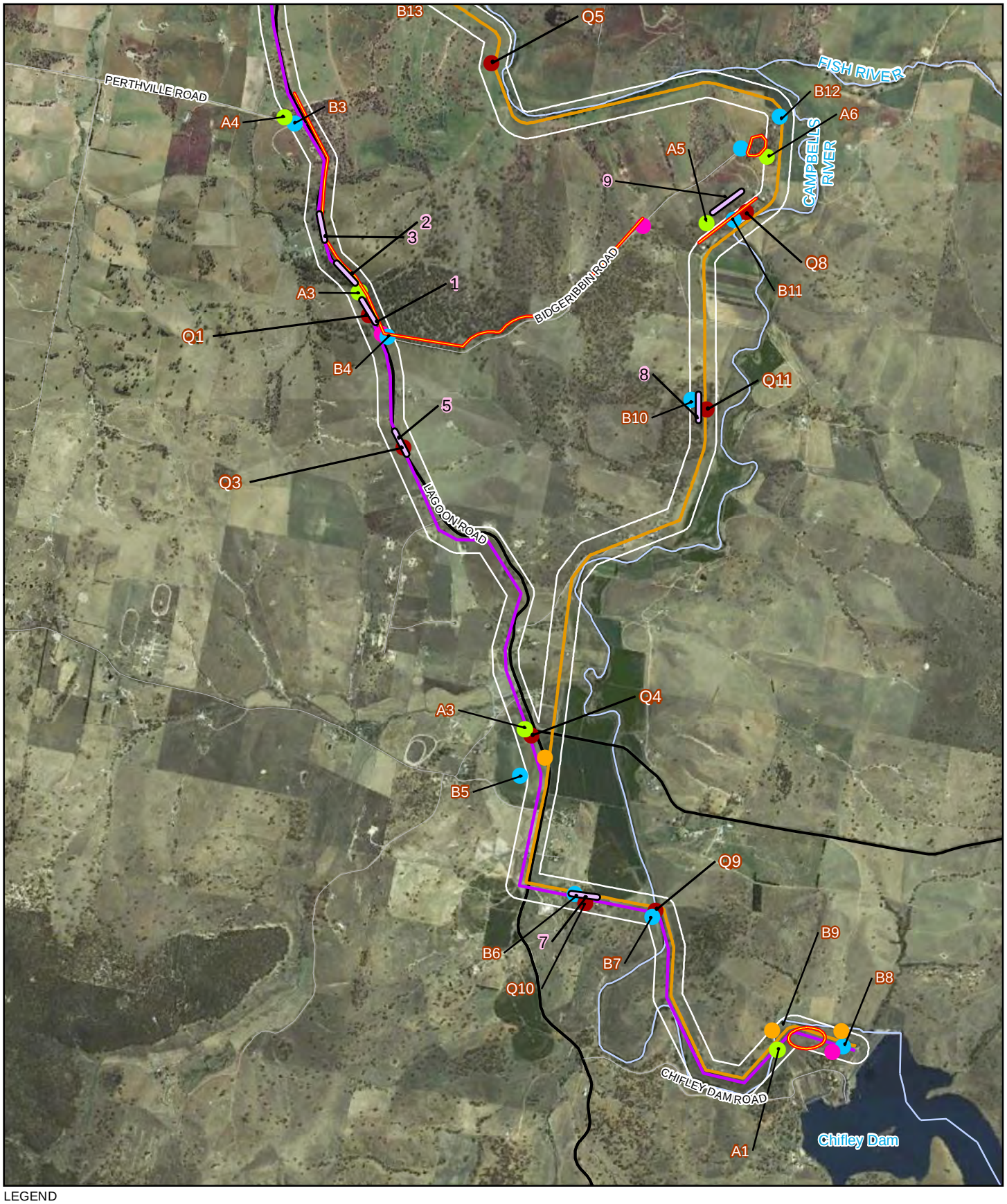
Survey locations

Figure 2 (b)

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z007_SurveyLocations_revised.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011. Created by:cwilson



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- HBTTransect
- Spotlighting
- Anabat
- Bird survey
- Call playback
- Platypus survey
- Frog survey
- Flora quadrats
- Highways
- Major Roads
- Secondary Roads
- Other Roads

1:40,000 (at A4)

0 250 500 1,000 1,500

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Job Number 21-21844

Revision 1

Date 01 Feb 2013

Survey locations

Figure 2 (b)

\\ghdnet\ghd\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z007_SurveyLocations_revised.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011. Created by:cwilson

4. Existing Environment

This chapter details the biodiversity values present in the study area. It includes the results of the desktop assessment and field surveys. A discussion of the conservation significance of the study area is provided.

4.1 Database results

A number of databases were accessed for information on threatened biota of relevance to the study area, as detailed in section 3.1. The results of these database searches are provided below.

4.1.1 Threatened ecological communities

Two threatened ecological communities (TECs) listed under the TSC Act have been recorded in the Bathurst CMA subregion (OEH 2012b). These are Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions Endangered Ecological Community (EEC) and White Box Yellow Box Blakely's Red Gum Woodland EEC. One TEC listed under the EPBC Act (White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC)) is predicted to occur in the locality (DSEWPaC 2012a) (Appendix A). Threatened communities identified in the study area are discussed in more detail in sections 4.3.2 and 4.4.1.

4.1.2 Threatened populations and species

The Atlas of NSW Wildlife database (OEH 2012a) identifies eight threatened flora species listed under the TSC Act previously recorded in the locality. The protected matters search (DSEWPaC 2012a) identifies five threatened flora species listed under the EPBC Act as potentially occurring in the study area. Threatened flora species known or considered likely to occur based on habitat present are discussed in more detail in sections 4.3.1 and 4.4.1.

The Atlas of NSW Wildlife database (OEH 2012a) identifies 25 threatened fauna species (18 bird species, five mammal species, and two frog species) listed under the TSC Act as having been previously recorded in the locality. The protected matters search (DSEWPaC 2012a) identifies 13 threatened fauna species (not including fish) listed under the EPBC Act as potentially occurring in the locality (see Appendix A). Note that OEH records are from 1980 onwards. Additional species are included in Council's database, however many of these have not been recorded in the area for over 30 years, with some considered extinct in the region (such as the Bilby) (see Appendix A). Threatened fauna species known or considered likely to occur based on habitats present are discussed in more detail in sections 4.3.3, 4.3.4 and 4.4.2.

4.1.3 Migratory species

The Protected Matters Search (DSEWPaC 2012a) identifies 15 migratory species listed under the EPBC Act as potentially occurring in the study area. Additional species were identified in Council's database and Birdlife Australia's database (see Appendix A). Migratory species known or considered likely to occur based on habitat present are discussed in more detail in sections 4.3.3 and 4.4.3.

The EPBC Act also protects all species in the family Accipitridae (kites, eagles and hawks), Falconidae (falcons and kestrels), Anatidae (ducks), Charadriidae (Plovers, Lapwings and Dotterels), Muscicapidae (Thrushs), Phoenicopteridae (Flamingos), Recurvirostridae (Avocets and Stilts) and Scolopacidae (Snipes, Godwits, Sandpipers etc), and all species in the genus

Grus (Brolga and Sarus Crane) for which Australia is a Range State. Species of potential relevance to this proposal include eagles, kites and falcons, and ducks.

4.1.4 Other matters of national environmental significance

No other ecological MNES were identified by the Protected Matters Search as occurring or likely to occur in the locality.

4.2 Literature review

Literature of relevance to the study area included previous vegetation mapping of the region (DEC 2006) and the Pre-feasibility Assessment (THC 2008). These were reviewed and are discussed below.

4.2.1 Vegetation mapping

Vegetation mapping provided by Council (DEC 2006) identifies four vegetation types as being present within or adjacent to the pipeline route options. These are listed in Table 3 below and mapped in Figure 3.

Table 3 Vegetation types previously mapped in the study area (DEC, 2006)

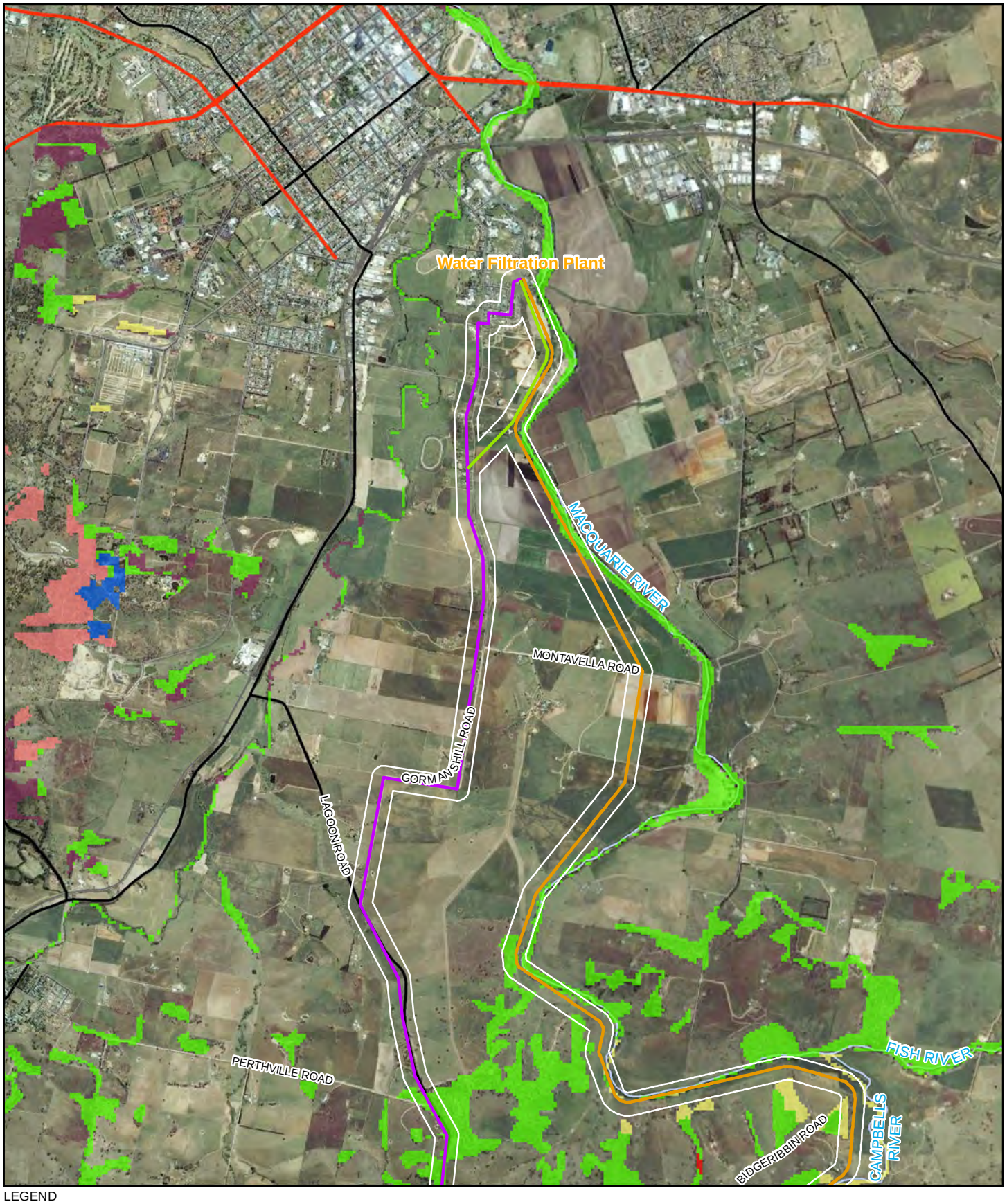
Vegetation Type	Map Unit	TSC Act Status	EPBC Act Status
Blakeley's Red Gum – Yellow Box open woodland of the tablelands	BVT 46	Likely to equate to Box-gum woodland EEC	Some better quality patches may equate to Box-gum woodland CEEC
Apple Box – Yellow Box – Mountain Gum open woodland on flats and low hills of the tablelands	BVT 44	Likely to equate to Box-gum woodland EEC	Some better quality patches may equate to Box-gum woodland CEEC
Mountain Gum – Red Stringybark open forest at high altitudes	BVT 4	May equate to Tableland Basalt Forest EEC	
Blakeley's Red Gum – Rough-barked Apple woodland on flats and alluvial terraces	BVT 17	Likely to equate to Box-gum woodland EEC	Some better quality patches may equate to Box-gum woodland CEEC
Wetlands	BVT 1005	N/A	N/A

4.2.2 Pre-feasibility Assessment

The Pre-feasibility Assessment (HTC 2008) provides a high level assessment of the likelihood of threatened biota being present in the study area. The following threatened biota are considered relevant to the project:

- White Box – Yellow Box – Blakeley's Red Gum Grassy Woodland and Derived Native Grassland (TEC listed under both the TSC Act and the EPBC Act, although the community definitions for the two listings differ).
- Ten threatened flora species (listed under the TSC Act and/or the EPBC Act) recorded in the CMA subregion, of which two had been recorded from the locality. *Eucalyptus pulverulenta* and *Lepidium hyssopifolium* were considered to have the potential to occur in woodland in the study area.
- Forty-four threatened flora species (listed under the TSC Act and/or the EPBC Act) recorded in the CMA subregion, of which thirteen had been recorded from the locality. Two threatened mammals, seven threatened birds, one threatened reptile and two threatened frogs were considered to have the potential to occur in the study area.

Threatened biota identified in the pre-feasibility assessment as having the potential to occur in the study area have been included in the assessment of likelihood of occurrence in this report (see Appendix A).



LEGEND

Route 1 - Alternate
Route 1
Route 1
Route 2

Vegetation Communities

Apple Box - Yellow Box - Mountain Gum open-woodland on flats and low hills of the central tablelands

Blakely's Red Gum - Rough Barked Apple woodland on flats and alluvial terraces

Blakely's Red Gum - Yellow Box open-woodland of the tablelands

Mountain Gum - Red Stringybark open-forest at high altitudes

Red Stringybark - Blakely's Red Gum - Yellow Box woodland

Scribbly Gum - Brittle Gum - Box woodland

Scribbly Gum woodland

Stringybark - Box - Gum Woodland

Highways
Major Roads
Secondary Roads
Other Roads

1:45,000 (at A4)

0 250 500 1,000 1,500

Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council
Chifley Dam Pipelines

Job Number	21-21844
Revision	2
Date	13 Mar 2013

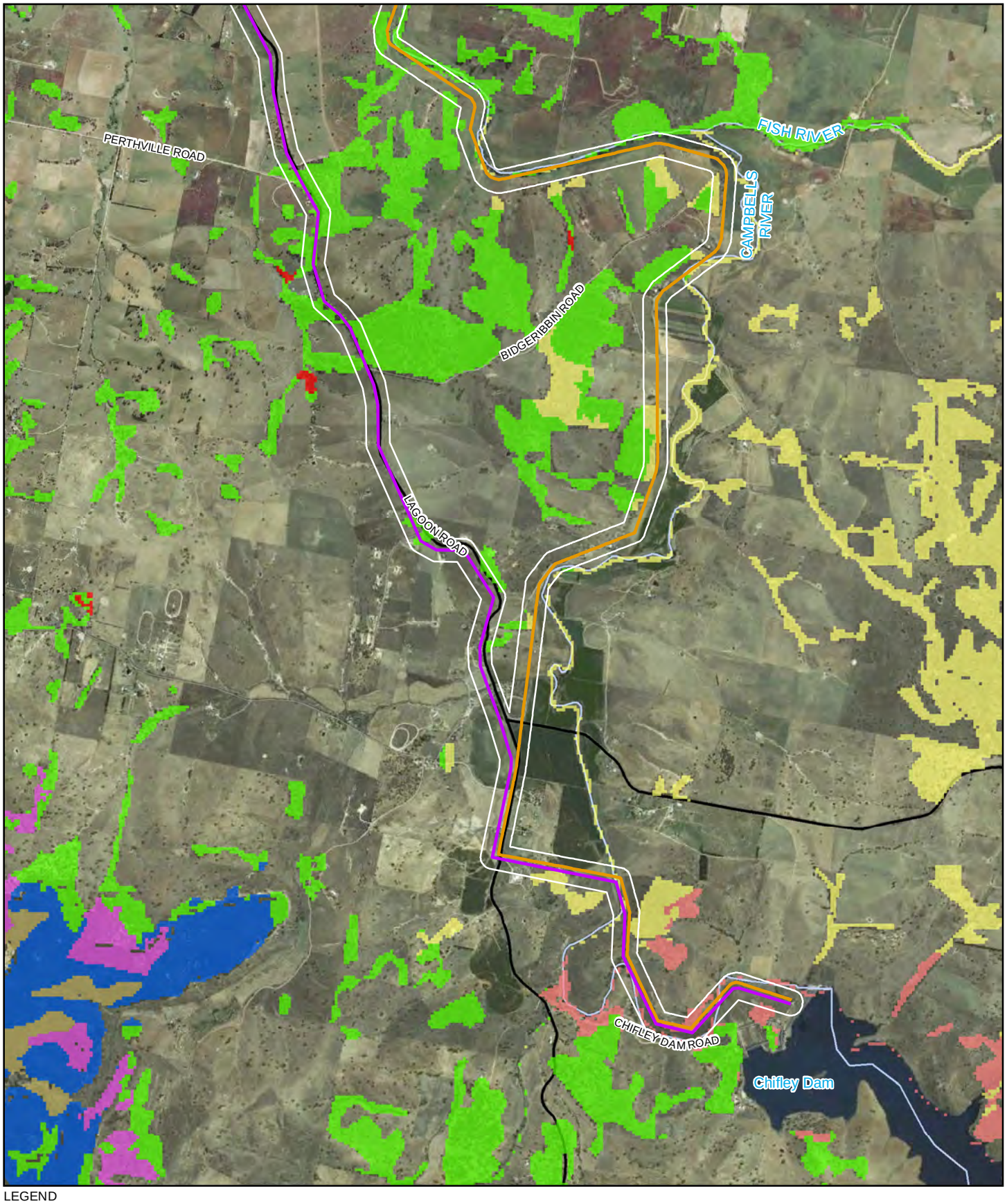
Regional Vegetation Mapping

Figure 3 (b)

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z010_RegionalVegetation_RevB.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, November, 2012; Vegetation Communities recieved from Client, 2012. Created by:cwilson



LEGEND

Route 1 - Alternate
Route 1
Route 1
Route 2

Vegetation Communities

Apple Box - Yellow Box - Mountain Gum open-woodland on flats and low hills of the central tablelands

Blakely's Red Gum - Rough Barked Apple woodland on flats and alluvial terraces

Blakely's Red Gum - Yellow Box open-woodland of the tablelands

Mountain Gum - Red Stringybark open-forest at high altitudes

Red Stringybark - Blakely's Red Gum - Yellow Box woodland

Scribbly Gum - Brittle Gum - Box woodland

Scribbly Gum woodland

Stringybark - Box - Gum Woodland

Highways
Major Roads
Secondary Roads
Other Roads

1:45,000 (at A4)

0 250 500 1,000 1,500

Metres

Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council
Chifley Dam Pipelines

Job Number	21-21844
Revision	1
Date	07 Feb 2013

Regional Vegetation Mapping

Figure 3 (b)

\\ghdnet\ghd\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z010_RegionalVegetation_RevB.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, November, 2012; Vegetation Communities recieved from Client, 2012. Created by:cwilson

4.3 Survey results

Results of terrestrial flora and fauna surveys conducted by GHD are provided below.

4.3.1 Flora species

A total of 114 species of flora were recorded within the study area, comprising 45 native species and 69 exotic species. The Poaceae (grasses, 23 species, 10 native; 13 exotic), Asteraceae (daisy's, 15 species, four native; 11 exotic) and Fabaceae (pea-flowers, nine species, one native, eight exotic) were the most species-rich families recorded. This is a relatively low diversity of native plant species for the 11 plots and total area sampled, probably reflecting the extensive disturbance and modification of the study area for agricultural activities. A single 20m x 20m vegetation survey plot within the woodland vegetation types in the study area would be expected to have 21-30 native plant species according to the vegetation benchmarks database (OEH, 2012e).

No threatened plants were recorded within the study areas.

The full list of plant species recorded is presented in Appendix B. Dominant species recorded within each of the vegetation types occurring within the study area are discussed below.

4.3.2 Vegetation types

Based on the fine-scale vegetation mapping and flora sampling performed by GHD, six vegetation types were identified during field survey, of which four are native, one is planted, and one is exotic. Two of the vegetation types identified had been previously mapped in the area (DEC 2006; see Figure 3).

Vegetation types mapped within the study areas are shown on Figure 4a, 4b and 4c and are summarised in Table 4 and described below. Native vegetation occurs as isolated remnant or regrowth patches, surrounded by existing disturbance including cleared grazing land, cropland, water storages, roads and other infrastructure. The largest remnant vegetation patches are on the slopes above Chifley Dam and near the intersection of Bidgeribbin Road and Lagoon Road. All other native vegetation in the surface disturbance area occurs as patches of under ten hectares in size. These patches are moderately to severely degraded by weed infestation, ongoing grazing and edge effects.

Table 4 Vegetation types in the study area

Vegetation Type	Map Unit	TSC Act Status	EPBC Act Status
Blakeley's Red Gum – Yellow Box woodland	BVT 46	Box-gum woodland EEC	Does not meet EPBC Act criteria
Apple Box – Yellow Box woodland	BVT 44	Box-gum woodland EEC	Does not meet EPBC Act criteria
Planted Blakely's Red Gum – Yellow Box woodland	BVT 46	Box-gum woodland EEC	Does not meet EPBC Act criteria
River Oak riparian forest	BVT 29	Not listed	Not listed
Freshwater Wetland	BVT 1005	Not listed	Not listed
Exotic grassland		Not applicable	Not applicable

Blakely's Red Gum – Yellow Box woodland

Blakely's Red Gum – Yellow Box woodland is equivalent to the DEC (2006) BVT 46 'Blakely's Red Gum – Yellow Box open woodland of the tablelands'. Blakely's Red Gum – Yellow Box woodland is the most extensive native vegetation community within the study area. It occurs on rolling low hills, generally as isolated remnant patches in grazing country or linear strips in road reserves.

Blakely's Red Gum – Yellow Box woodland in the study area features a canopy of Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*E. melliodora)* with a very sparse shrub layer and a grassy understorey. The canopy is dominated by sub-mature regrowth trees (10 – 30cm diameter at breast height (DBH) with a limited number of mature (30 – 90cm DBH) trees and few saplings (<10cm DBH). Apple Box (*E. bridgesiana*) is sub dominant. There are very occasional native shrubs such as Sticky Cassinia (*Cassinia uncata*) and Green Wattle (*Acacia deanei*). There are localised patches of exotic small trees and shrubs such as Hawthorn (*Crataegus monogyna**) and Orange Firethorn (*Pyracantha angustifolia**).

The understorey is dominated by a dense cover of exotic grasses such as Barley Grass (*Hordeum leporinum**), Great Brome (*Bromus diandrus**), Wild Oats (*Avena fatua**) and Annual Ryegrass (*Lolium rigidum**) and herbs including Pattersons Curse (*Echium plantagineum**) and Dandelion (*Taraxacum officianale**). There are occasional native tussock grasses such as Speargrass (*Austrostipa scabra*) and Wallaby Grasses (*Austrodanthonia* spp.) and native herbs including Kidney Weed (*Dichondra repens*), Purple Burr-Daisy (*Calotis cuneifolia*), Tufted Bluebell (*Wahlenbergia communis*) and Acaena (*Acaena ovina*). Bare ground and litter make up a substantial proportion of the ground cover.

Blakely's Red Gum – Yellow Box woodland in the study area is in moderate to poor condition. Native over storey cover is good and there are moderate numbers of mature trees including occasional hollow-bearing trees. However native species richness is low (less than 15 species per plot), native understorey cover is low (typically less than 10% foliage projective cover) and exotic plant cover is generally high (greater than 50% foliage projective cover). There does not appear to be any intact patches of Blakely's Red Gum – Yellow Box woodland in the study area. The entire extent of this vegetation type in the study area appears to have been partially cleared and/or under scrubbed. Many areas appear to have been sown with exotic pasture at some point and there are moderate to severe infestations of exotic grasses, herbaceous environmental weeds and noxious weeds throughout. The majority of this vegetation type continues to be grazed by livestock.

This woodland meets the NSW TSC Act definition of the EEC "White Box- Yellow Box- Blakely's Red Gum Woodland" (Box-gum woodland) however does not qualify as the EPBC Act listed CEEC "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland" due to the low cover-abundance and species richness of native species in the understorey (refer Section 4.4.1 for more detail).

Apple Box – Yellow Box woodland

Apple Box – Yellow Box woodland is equivalent to the DEC (2006) BVT 44 'Apple Box – Yellow Box – Mountain Gum open woodland on flats and low hills of the central tablelands'. It occurs on lower slopes and flats above the Campbells River and Macquarie River, generally as isolated remnant patches in grazing country.

Apple Box – Yellow Box woodland at the site features a canopy of Apple Box (*Eucalyptus bridgesiana*) and Yellow Box (*E. melliodora)* with a very sparse shrub layer and a grassy understorey. Ribbon Gum (*E. viminalis*) is locally dominant in the southern portion of the study area. The canopy is dominated by mature (30 – 90cm DBH) trees and few saplings (<10cm

DBH). There are very occasional native shrubs and small trees such as Silver Wattle (*Acacia dealbata*).

The understorey is equivalent to that of Yellow Box Woodland described above and is dominated by a dense cover of exotic grasses such as Barley Grass (*Hordeum leporinum**), and herbs such as Tower Mustard (*Turritis glabra**). There are occasional native tussock grasses such as Speargrass (*Austrostipa scabra*) and native forbs including Many-flowered Mat-rush (*Lomandra multiflora* subsp. *multiflora*) and Acaena (*Acaena ovina*). Bare ground and litter make up a substantial proportion of the ground cover.

Apple Box – Yellow Box woodland in the study area is in moderate to poor condition (i.e. slightly to substantially below benchmark values listed in OEH, 2012e). Native over storey cover is high (15-30% foliage projective cover) and there are moderate numbers of mature trees including occasional hollow-bearing trees. However native species richness is low (less than 20 species per plot), native understorey cover is low to very low (typically less than 10% foliage projective cover) and exotic plant cover is generally high (greater than 50% foliage projective cover). The entire extent of this vegetation type in the study area appears to have been partially cleared and/or under scrubbed. Many areas appear to have been sown with exotic pasture at some point and there are moderate to severe infestations of exotic grasses, herbaceous environmental weeds and noxious weeds throughout. The majority of this vegetation type continues to be grazed by livestock.

This woodland meets the NSW TSC Act definition of the EEC 'White Box- Yellow Box- Blakely's Red Gum Woodland' (Box-gum woodland) however does not qualify as the EPBC act listed CEEC "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland" due to the low cover-abundance and species richness of native species in the understorey (refer Section 4.4.1 for more detail).

Planted Blakely's Red Gum – Yellow Box woodland

Planted Blakely's Red Gum – Yellow Box woodland features a canopy Blakely's Red Gum (*Eucalyptus blakelyi*), Apple Box (*E. bridgesiana*), Yellow Box (*E. melliodora)* and Green Wattle (*Acacia deanei*) with a grassy understorey. The canopy consists entirely of planted, sub-mature trees (10 – 30cm DBH).

The understorey is dominated by a dense cover of heavily grazed exotic grasses (foliage projective cover >70%).

This vegetation is clearly planted, but it is contiguous with remnant woodland Blakely's Red Gum – Yellow Box woodland, features an appropriate mix of canopy species and is on an appropriate substrate and so would comprise a modified occurrence of the NSW TSC Act definition of Box-gum woodland. It does not qualify as the CEEC listed under the EPBC Act due to the low cover-abundance and species richness of native species in the understorey (refer Section 4.4.1 for more detail).

River Oak riparian forest

River Oak riparian forest occurring in the study area is equivalent to the DEC (2006) BVT 29 'River Oak riparian woodland/forest of the slopes and tablelands'. It occurs as narrow, linear remnants on the banks and adjoining alluvial terraces of the Macquarie River.

The River Oak riparian forest features a canopy of River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) above a dense mid storey of small trees (<10cm DBH) and a dense understorey of forbs. The canopy is dominated by sub-mature regrowth trees (10 – 30cm diameter at breast height (DBH) with a limited number of mature (30 – 90cm DBH) *Casuarina cunninghamiana* subsp. *cunninghamiana* trees and occasional, isolated, very large Ribbon Gum (*Eucalyptus viminalis*) (>100cm DBH).

There is a very dense mid storey of either *C. cunninghamiana* subsp. *cunninghamiana* saplings (<10cm DBH), willows (S*alix* spp.*) or other exotic small trees and shrubs such as Hawthorn (*Crataegus monogyna**) (foliage projective cover >50%).

The understorey is dominated by a dense cover of exotic forbs such as Bishop's Weed (*Ammi majus**), Variegated Thistle (*Silybum marianum**) and Mediterranean Turnip (*Brassica tournefortii**) and grasses such as Great Brome (*Bromus diandrus**) and Cocksfoot (*Dactylis glomerata**) (foliage projective cover >70%). There is localised moderate cover of the native tussock grass Snowgrass (*Poa sieberiana* var. *sieberiana*) and sedges such as Common Reed (*Phragmites australis*) (up to 25% foliage projective cover).

River Oak riparian forest in the study area is in moderate to poor condition. Native over storey cover is high (around 50% foliage projective cover) and there are moderate numbers of both mature trees and regenerating *C. cunninghamiana* subsp. *cunninghamiana*. However native species richness is low (less than 10 species per plot), native understorey cover is very low (typically less than 10% foliage projective cover outside of the localised patches of sedges and tussock grasses described above) and exotic plant cover is high to very high (foliage projective cover >70%). The entire extent of this vegetation type features moderate to severe infestations of exotic grasses, herbaceous environmental weeds and noxious weeds. The majority of this vegetation type continues to be grazed by livestock.

Freshwater Wetland

The Freshwater Wetland falls within the DEC (2006) broad structural designation BVT 1005 'Wetlands'.

The Freshwater Wetland occupies an area of flat, poorly drained ground at The Lagoon, in the south west of the study area. It is a shallow, intermittent, freshwater wetland that contained surface water at the time of the GHD field survey.

The Freshwater Wetland contains a variety of structural vegetation associations, including: a wet herbfield dominated by Celery Buttercup *(Ranunculus sceleratus*)* with exotic grasses such as Barley Grass (*Hordeum leporinum**) and occasional native sedges such as Tall Sedge (*Carex appressa*); open sedgeland dominated by *Juncus usitasis* with *C. appressa* and occasional native herbs such as Pale Knotweed (*Persicaria lapathifolia*); and closed rush land dominated by Common Reed (*Phragmites australis*) or Broad-leaved Cumbungi *(Typha orientalis)*.

The Freshwater Wetland is in moderate condition with moderate to very high native understorey cover (foliage projective cover up to70%), good native regeneration, moderate native species richness (around 10 species per plot) and moderate to severe weed infestation (30-50% foliage projective cover). Lower lying, wetter portions of this vegetation type near the centre of the patch are in better condition. Drier portions around the edge of the patch resemble the exotic grassland described below. This vegetation type is currently grazed by livestock.

Exotic grassland

The remainder of the study area contains exotic grassland, cropped agricultural land, and hard stand areas such as roads, or infrastructure. These areas would have supported native woodland prior to European settlement, but have been extensively degraded and modified and feature close to 100% cover abundance of exotic species. These areas have very limited capacity for natural regeneration.

There are occasional isolated remnant trees, including Yellow Box (*Eucalyptus melliodora*) and Apple Box (*E. bridgesiana*), however there is virtually no regrowth of these canopy species.

The groundcover is dominated by exotic grasses such as Barley Grass (*Hordeum leporinum**), Great Brome (*Bromus diandrus**) and Annual Ryegrass (*Lolium rigidum**) or crop land. There are occasional native grasses such as Speargrass (*Austrostipa* scabra) or Wallaby Grass (*Austrodanthonia setaceae*) and sparse, patchy cover of native forbs including Common Everlasting (*Chrysocephalum apiculatum*) and Bidgee-widgee *(Acaena novae-zelandiae)*. There are herbaceous environmental weeds throughout, including Spear Thistle (*Cirsium vulgare**), Flaxleaf Fleabane (*Conyza bonariensis**) and Shepherd's Purse (*Capsella bursa-pastoris**).

Exotic grassland does not constitute a derived native grassland consistent with the definition for the EEC Box-gum woodland as listed under the TSC Act or the CEEC listed under the EPBC Act due to very low (<5% throughout) native understorey cover and low native species richness (refer Section 4.4.1).

4.3.3 Fauna species

Up to 132 fauna species were recorded during surveys. This included 100 bird species, eight terrestrial and arboreal mammal species, up to 10 bat species, seven reptile species and seven frog species. Eight introduced species were recorded, including five bird species and three mammal species. Seven threatened fauna species were recorded (see section 4.4 for more detail):

- Diamond Firetail (*Stagonopleura guttata*), listed as a vulnerable species under the TSC Act.
- Spotted Harrier (*Circus assimilis*), listed as a vulnerable species under the TSC Act.
- A Little Eagle (*Hieraaetus morphnoides*), listed as vulnerable under the TSC Act, was recorded flying over the study area near the locality of The Lagoon.
- Australian Painted Snipe (*Rostratula australis*), listed as an endangered species under the TSC Act and vulnerable under the EPBC Act.
- Booroolong Frog (*Litoria booroolongensis*), listed as an endangered species under the TSC Act and the EPBC Act.
- Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as a vulnerable species under the TSC Act and EPBC Act.
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), listed as a vulnerable species under the TSC Act.

An additional three threatened microbat species were recorded as ‘probable’ based on echolocation call analysis (see section 4.4 for more detail):

- Yellow-bellied Sheath-tail Bat (*Saccolaimus flaveventris*), listed as a vulnerable species under the TSC Act.
- Large-footed Myotis (*Myotis macropus*), listed as a vulnerable species under the TSC Act.
- Eastern Cave Bat (*Vespadelus troughtoni*), listed as a vulnerable species under the TSC Act.

Three migratory species listed under the EPBC Act were recorded (see section 4.4 for more detail):

- Australian Painted Snipe (*Rostratula australis*).
- Latham’s Snipe (*Gallinago hardwickii*).
- Rainbow Bee-eater (*Merops ornatus*).

A full list of fauna species recorded is provided in Appendix B.

4.3.4 Fauna habitats

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species potentially present in the study area. The study area has varying fauna habitat values, with large areas cleared for agricultural purposes, and some woodland and riparian areas. Species recorded included species that require large patches of native vegetation to persist, as well as generalist species able to utilise disturbed areas. The main habitat types are described below.

Open paddocks and cleared road reserve

Much of the study area comprises cleared agricultural land and cleared road reserve. Agricultural areas include grazing land and cropped land (see Photograph 1 and Photograph 2). Cleared road reserve and grazing land includes occasional paddock trees and fallen timber. Larger granite outcrops are present in paddocks near the Macquarie River at Gormans Hill. Very little surface rock is present in the study area. Occasional small patches of exfoliating rock are present on the hillsides above Campbells River near Chifley Dam. Otherwise paddocks have generally been cleared of small surface rock if it was present historically.

Photograph 1 Cropped Land

Photograph 2 Grazing Land

Species recorded in these areas included a range of common birds typical of rural landscapes such as the Australian Magpie (*Cracticus tibicen*), Galah (*Eolophus roseicapilla*), Eastern Rosella (*Platycercus eximius*), Crimson Rosella (*Platycercus elegans*), Brown Quail (*Coturnix ypsilophora*), Brown Falcon (*Falco berigora*), and Black-shouldered Kite (*Elanus axillaris*).

Eastern Grey Kangaroos (*Macropus giganteus*) were recorded in the study area and would forage in open paddocks (particularly grazing land) and take water at dams. A number of microbat species would forage over these areas, including the threatened Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), which was recorded at a number of locations in the study area. Common Wombat (*Vombatus ursinus*) burrows were observed in a number of locations.

These areas generally provide minimal habitat for threatened fauna, however a Spotted Harrier (*Circus assimilis*) (listed as a vulnerable species under the TSC Act) was observed hunting over an area including paddocks and farm dams near Gorman's Hill.

Areas of large granite boulders are present near the first crossing of Campbells River, and near Gorman's Hill Road. Few reptiles were observed. Cunninghams Skinks (*Egernia cunninghamii*) were observed in rock crevices in large granite boulders. A skin of an unidentified snake was found in rocks near HBT transect 6. Weasel Skinks (*Saproscincus mustelinus*) were recorded under fallen timber in open paddocks. No lizards were recorded under surface rock in the study

area. Given the general lack of surface rock and native grasses, and history of grazing and crop cultivation, it is unlikely that any threatened lizards occur in these areas.

Introduced species such as Common Starlings (*Sturnus vulgaris*), Foxes (*Vulpes vulpes*), Rabbits (*Oryctolagus cuniculus*) and Brown Hares (*Lepus capensis*) were regularly observed.

Woodland areas

Woodland patches are scattered throughout the study area, occurring in particular along the road reserve of Lagoon Road, and in some paddock areas (see Photograph 3, Photograph 4, Photograph 5 and Photograph 6). Woodland areas generally consist of a small number of eucalypt species, with minimal shrub layer and little native groundcover. Mistletoes are usually present. Foraging habitat is present for a range of bird species, and these areas have a higher species diversity than paddocks and narrow strips of trees along roads. Species recorded included the threatened Diamond Firetail (*Stagonopluera guttata*), listed as vulnerable under the TSC Act, and other small birds such as the Weebill (*Smicrornis brevirostris*), White-throated Gerygone (*Gerygone olivacea*), Jacky Winter (*Microeca fascinans*), Mistletoebird (*Dicaeum hirundinaceum*), Dusky Woodswallow (*Artamus cyanopterus*), Rufous Whistler (*Pachycephala rufiventris*), Red-browed Finch (*Neochmia temporalis*), Spotted Pardalote (*Pardalotus punctatus*), Yellow-faced Honeyeater (*Lichenostomus chrysops*) and White-plumed Honeyeater (*Lichenostomus penicillatus*). Larger birds included rosellas, Dollarbirds (*Eurystomus orientalis*), Noisy Miners (*Manorina melanocephala*), Noisy Friarbirds (*Philemon corniculatus*), Grey Butcherbirds (Cracticus torquatus), Black-faced Cuckoo-shrikes (*Coracina novaehollandiae*) and White-winged Choughs (*Corcorax melanorhamphos*). A Little Eagle (*Hieraaetus morphnoides*) was recorded soaring over a woodland patch and adjacent agricultural land near the locality of The Lagoon.

Most of the native vegetation in the study area is dominated by secondary Koala food tree species (*Eucalyptus blakelyi, E. bridgesiana* and *E. melliodora)* with a very sparse shrub layer (<5% foliage projective cover) and a grassy understorey. The primary food tree *Eucalyptus viminalis* occurs in the southern part of the study area near Chifley Dam. Large scratches were observed in some trees, and are likely to be from Koalas. No Koala scats were found. While none were observed during the survey, many local residents (particularly near Bidgeribbin Road) mentioned seeing Koalas in the area on occasion. Koalas are likely to forage in the larger woodland patches in the study area, and may use the study area for dispersal. The study area is classified as 'Potential Koala habitat' according to SEPP 44. Given the low numbers of records of the species in the study area, it is possible that Koalas do not breed in the study area, rather breeding in the Rockley Mount area where there are many records of the species. Further study would be required to determine whether any areas of the study area classify as 'Core Koala habitat'.

Hollow-bearing trees are present in most woodland patches. Hollows are generally of a small size (5-10 cm in diameter), although very occasional larger hollows are present (20 cm diameter). Hollow-bearing trees were found to make up generally about 33% of the trees in the 200 m x 10 m transects. Transect 2 had the lowest density (17%), while at transects 6 and 9 hollow-bearing trees made up about 70% of the trees present. Hollow-dependent fauna recorded included Sugar Gliders (*Petaurus breviceps*) and Common Brush-tailed Possums (*Trichosurus vulpecula*), as well as the Galah (*Eolophus roseicapilla*), Eastern Rosella (*Platycercus eximius*), Crimson Rosella (*Platycercus elegans*), and Red-rumped Parrots (*Psephotus haematonotus*). A range of common hollow-dependent bats were recorded. One threatened hollow-dependent microbat, the Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*, listed as vulnerable under the TSC Act) was potentially recorded (call identified as 'probable' based on recorded bat call analysis). The White-striped Freetail Bat (*Tadarida australis*) was regularly heard echolocating in woodland patches. A Cunningham's Skink

(*Egernia cunninghamia*) was also observed in a small hollow at the base of a tree. Given the smaller size of most hollows recorded, it is unlikely that the Barking Owl (*Ninox connivens*) would nest in the study area, although not all hollow-bearing trees were mapped for this study and some suitable hollows may be present.

Some leaf litter and fallen timber is present in these areas. Few reptiles were observed, except for occasional litter skinks (most probably species of *Lampropholis*). Evidence of Short-beaked Echidnas (*Tachyglossus aculeatus*) (diggings and scats) was seen in places. Eastern Grey Kangaroos (*Macropus giganteus*) were observed in many of the woodland patches and the Swamp Wallaby (*Wallabia bicolor*) was observed in riparian woodland near the Macquarie River.

Photograph 3 Woodland Near Paddock

Photograph 4 Easement Through Woodland

Photograph 5 Roadside Vegeation with Adjacent Woodland

Photograph 6 Roadside Vegetation in Cleared Areas

Freshwater wetland

The Freshwater Wetland (Aspley Lagoon) (Photograph 7) is in the locality of The Lagoon, and is an ephemeral swamp surrounded by grazing and cropped land. While it is Crown Land, cattle and horses have access to the area under lease agreements. Route 1 passes along the road reserve adjacent to the freshwater wetland. The margins of the freshwater wetland are vegetated with a range of reeds and sedges. Patches of Blackberry are also present, particularly on the north-western side of the wetland.

This intermittent wetland provides good habitat for threatened and migratory waders. A pair of Australian Painted Snipe (*Rostratula australis*) was observed foraging along the shore adjacent to a patch of Blackberry on two occasions. This species is listed as endangered under the TSC Act and vulnerable and migratory under the EPBC Act. At least three Latham's Snipe (*Gallinago*

hardwicki) were observed on two occasions, flying out of a patch of *Juncus* when disturbed. This species is listed as migratory under the EPBC Act. The Black-tailed Godwit (*Limosa limosa*), Sharp-tailed Sandpiper (*Calidris acuminata*), Glossy Ibis (*Plegadis falcinellus*) and White-bellied Sea-eagle (*Haliaeetus leucogaster*), also listed as migratory under the EPBC Act, have been previously recorded at the freshwater wetland according to records supplied by Council. The Australian Painted Snipe could potentially breed at the freshwater wetland. Most records of nesting sites for this species are from islands within wetlands, although the species has been known to nest near swamps and in grazing land (DSEWPaC 2012b). Latham's Snipe and the Black-tailed Godwit and Sharp-tailed Sandpiper are non-breeding visitors to Australia. The Glossy Ibis breeds in large wetlands in northern Australia. The White-bellied Sea-eagle is likely to breed near larger waterbodies, such as the Macquarie River or Chifley Dam. These species are discussed further in section 4.4.

A range of common waterbirds were also observed at the freshwater wetland, including the Pacific Black Duck (*Anas superciliosa*), Pink-eared Duck (*Malacorhynchus membranaceus*), Black-fronted Dotterel (*Elseyornis melanops*), Spotless Crake (*Porzana tabuensis*), Long-toed Stint (*Calidris subminuta*) and Black-winged Stilt (*Himantopus himantopus*). A variety of bat species were recorded, including the Chocolate Wattled Bat (*Chalinolobus morio*), Eastern Bentwing Bat, Large Forest Bat (*Vespadelus darlingtoni*) and Little Forest Bat (*Vespadelus vulturnus*). An Eastern Long-necked Turtle (*Chelodina longicollis*) was observed, and a number of frogs were heard calling, including the Common Eastern Froglet (*Crinia signifera*), Eastern Sign-bearing Froglet (*Crinia parinsignifera*), and Spotted Grass Frog (*Limnodynastes tasmaniensis*).

Photograph 7: Freshwater Wetland

Photograph 8: Cobble Habitat Along River

Campbells and Macquarie Rivers

Campbells River is located in the southern portion of the study area. In the study area, it runs from Chifley Dam in the south to its confluence with the Fish River, about midway along the study area. The confluence of the Fish River and Campbells River is the start of the Macquarie River, which then runs in a generally northerly direction towards Bathurst.

Both Campbells and the Macquarie Rivers are cut into deep alluvial soils along much of their length in the study area. In some locations, granite outcrops are present, forming rocky cliffed sides of the rivers. These were noted in particular north of Chifley Dam, forcing Campbells River to bend to the west. The river bed appears to generally have a silt and sand base, with occasional patches of cobbles and pebbles (see Photograph 8). These patches are present along the first reach of Campbells River north of Chifley Dam, and in a couple of places on the Macquarie River north of where Montavella Road meets the river. The edges of the rivers are generally dominated by weeds, although there are occasional sections with native riparian

vegetation types. Little emergent vegetation is present along the rivers, however snags are relatively common.

Waterbirds were observed in places along the rivers. These included Pacific Black Ducks (*Anas superciliosa*) and Dusky Moorhens (*Gallinula tenebrosa*). Small birds such as Superb Fairy-wrens (*Malurus cyaneus*) and White-browed Scrubwrens (*Sericornis frontatus*) were regularly observed in weedy riparian vegetation. A variety of microchiropteran bat species were recorded, including the Large-footed Myotis (*Myotis macropus*), listed as vulnerable under the TSC Act.

The Eastern Banjo Frog (*Limnodynastes dumerilii dumerilii*) was heard calling during the day and night along the rivers. A Booroolong Frog (*Litoria booroolongensis*), listed as endangered under the TSC Act and EPBC Act, was observed in a section of pebbles and cobbles along the Macquarie River, near Montavella Road. This species is discussed further in section 4.4.

Two local residents mentioned that Platypus (*Ornithorhynchus anatinus*) are present along the two rivers. Possible ripples of a Platypus were observed near where the Booroolong Frog was recorded on the Macquarie River, however the species was not positively identified. The steep alluvial river banks provide good burrow habitat for the Platypus. One resident also mentioned that Water Rats (*Hydromys chrysogaster*) are also observed on occasion.

Farm dams

Farm dams are located in paddocks throughout the study area. Some are located in mostly cleared paddocks, while others are located near patches of woodland. Levels of emergent vegetation vary between dams. Some have a good cover of emergent fringing aquatic vegetation, while others (particularly where cattle are present) have little fringing vegetation. Common species of waterbird were observed at many dams, including Pacific Black Ducks (*Anas superciliosa*), Grey Teals (*Anas gracilis*), Australian Wood Ducks (*Chenonetta jubatus*) and Australasian Grebes (*Tachybaptus novaehollandiae*). Common frogs were heard calling from most dams, including the Common Eastern Froglet (*Crinia signifera*), Eastern Sign-bearing Froglet (*Crinia parinsignifera*), Spotted Grass Frog (*Limnodynastes tasmaniensis*), Smooth Toadlet (*Uperoleia laevigata*) and Peron's Tree Frog (*Litoria peronii*). The dams are generally isolated from each other by large expanses of cleared agricultural land, and are unlikely to provide habitat for any threatened frogs.

4.4 Conservation significance

Various threatened and migratory biota were recorded during surveys, including a threatened ecological community listed under the TSC Act, threatened species listed under the TSC Act and the EPBC Act, and migratory species listed under the EPBC Act. These are detailed below.

4.4.1 Threatened ecological communities

The study area contains one threatened ecological community: White Box Yellow Box Blakely's Red Gum Woodland (Box-gum woodland) which is listed as an EEC under the TSC Act. Some patches of this EEC in the locality may also comprise White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is listed as a CEEC under the EPBC Act. The identification criteria for Box-gum woodland differ between the TSC Act and EPBC Act with greater emphasis at the federal level based on the composition and abundance of native groundcover species. Vegetation within the study area was assessed against the identification criteria for Box-Gum Woodland under the TSC Act (Table 5) and the CEEC listed under the EPBC Act (Table 6).

Table 5 TSC Act criteria for the identification of Box-gum Woodland EEC (DEC 2006b)

Criteria	Description	Does the site meet the criteria?
1	Does the site fall within the area defined in the NPWS Scientific Determination for Box-gum woodland EEC?	Yes
2	Are characteristic trees White Box, Yellow Box or Blakely's Red Gum present (or likely to have been present) at the site?	Yes
3	Is the site mainly grassy?	Yes
4	Do any of the listed characteristic species occur?	Yes
5	If the site is degraded, is there potential for assisted regeneration of the overstorey or understorey?	Yes

Blakely's Red Gum – Yellow Box woodland and Apple Box – Yellow Box woodland comprise Box-gum woodland as listed under the TSC Act and defined by DEC (2006b) identification criteria. Planted Blakely's Red Gum – Yellow Box woodland also comprises a modified form of the Box-gum woodland EEC.

Table 6 EPBC Act criteria for the identification of Box-gum Woodland CEEC (DEW 2006a)

Criteria	Description	Does the site meet the criteria?
1 and	Does the site contain or has previously contained White Box, Yellow Box or Blakely's Red Gum?	Yes
2 and	Does the site have a predominately native understorey?	No
3 and	Is the patch 0.1 ha or greater in size?	Yes
4 and	Are there 12 or more native understorey species present (excluding grasses)?	No
5 or	Is the site in "reasonable" condition? (i.e. At least one of the understorey species should be an important species as listed in DEH, 2006b).	Yes
6	Where sites do not meet the criteria 4 and 5, is the patch 2 ha or greater in size?	No
7	If yes, then does the patch have an average of 20 or more mature trees per hectare or is there natural regeneration of dominant overstorey Eucalypts?	Yes

The condition criteria outlined above are the minimum level at which patches are to be included in the threatened ecological community listed under the EPBC Act. None of the vegetation in the study area meets these condition criteria. There are patches of grassy woodland with characteristic canopy species throughout the study area and some characteristic understorey species, including important species (e.g. grazing-sensitive, regionally significant or uncommon species which are listed as important species in DEH, 2006b). However there are no patches with a predominantly native understorey. The Committee considers that areas in which an over storey exists without a substantially native understorey are no longer a viable part of the ecological community and in order for an area to be included in the listed CEEC, a patch must have a predominantly native understorey (DEH, 2006b).

The extent of Box-gum woodland in the study area is shown in Figure 4a, 4b and 4c.

One other EEC has been recorded in the Bathurst CMA subregion (OEH 2012b): Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions. The field surveys confirmed that this EEC is not present in the study area.

4.4.2 Threatened species

No threatened flora species were recorded during the field surveys.

Based on the habitat assessments undertaken and recent records in the locality two threatened flora species are likely to occur in the study area (Appendix A). These are presented in Table 7 below.

As discussed above, seven threatened fauna species were definitely recorded during surveys (see Figure 4). These included:

- Diamond Firetails, listed as vulnerable under the TSC Act, were recorded in two woodland patches, one near Chifley Dam, and one on a property near the bottom of Bidgeribbin Road. Potential habitat for this species is located throughout larger woodland patches the study area.
- A Spotted Harrier, listed as vulnerable under the TSC Act, was recorded in open agricultural country adjacent to Gorman's Hill Road. Potential habitat for this species is located throughout the study area.
- A Little Eagle, listed as vulnerable under the TSC Act, was recorded flying over the study area near the locality of The Lagoon.
- A pair of Australian Painted Snipe, listed as endangered under the TSC Act and vulnerable and migratory under the EPBC Act, was recorded at the freshwater wetland at The Lagoon.
- A Booroolong Frog, listed endangered under the TSC Act and the EPBC Act, was recorded on a pebbled section of the Macquarie River, north of Montavella Road. Potential habitat for this species is also located on the Campbells River downstream of Chifley Dam.
- A Grey-headed Flying-fox, listed as vulnerable under the TSC Act and the EPBC Act, was recorded flying over the study area above Gormans Hill Road.
- The Eastern Bentwing-bat, listed as vulnerable under the TSC Act, was recorded at a number of locations in the study area.

Three threatened microbats were recorded as 'probable' based on recorded echolocation analysis (see Figure 4). These included:

- The Yellow-bellied Sheathtail Bat, listed as vulnerable under the TSC Act, was probably recorded at Campbells River near Chifley Dam and at the freshwater wetland (based on one call each).
- The Large-footed Myotis, listed as vulnerable under the TSC Act, was probably recorded (based on eight calls) at the Macquarie River.
- The Eastern Cave Bat (*Vespadelus troughtoni*) listed as vulnerable under the TSC Act.

A range of other threatened fauna species are likely to occur in the study area (Appendix A). These are summarised in Table 7 below.

4.4.3 Migratory species

Two migratory species listed under the EPBC Act were recorded at the freshwater wetland during the field surveys:

- Australian Painted Snipe (also listed as Endangered under the EPBC Act).
- Latham's Snipe (*Gallinago hardwickii*).

A range of other migratory wetland birds may occur at this wetland on occasion. There are previous records of the Black-tailed Godwit (*Limosa limosa*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Glossy Ibis (*Plegadis falcinellus*) at this wetland. Other migratory species such as the Cattle Egret (*Ardea ibis*) and Great Egret (*Ardea alba*) are also likely to occur. The Black-tailed Godwit, Glossy Ibis and Latham's Snipe are likely to only be occasional non-breeding visitors. The Australian Painted Snipe and the two egrets may breed as well as forage in the study area. The White-bellied Sea-eagle (*Haliaeetus leucogaster*) may forage on occasion at the wetland.

The Rainbow Bee-eater (*Merops ornatus*) was recorded at a number of locations in woodland and farmland. This species is likely to forage and breed throughout much of the study area.

Table 7 Threatened biota known or likely to occur in the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Recorded during surveys	Likelihood of occurrence* Route 1	Likelihood of occurrence* Route 2
TECs						
White Box – Yellow Box Grassy Woodland		EEC	Does not meet EPBC Act criteria	Yes	Present. Recorded along sections of Lagoon Road and Gormans Hill Road	Present. Recorded in some paddocks
FLORA						
Euphrasia scabra	Rough Eyebright	E		No	Likely. Suitable habitat near the freshwater wetland at The Lagoon.	Likely. Suitable habitat near the freshwater wetland at The Lagoon.
Lepidium hyssopifolium	Aromatic Peppercress	E	E	No	Likely. Suitable habitat present in woodland and derived grasslands in the study area.	Likely. Suitable habitat present in woodland and derived grasslands in the study area.
FAUNA						
Birds						
Rostratula australis	Australian Painted Snipe	E	V, M	Yes	Present. Recorded at the lagoon.	Present. Recorded at the lagoon.
Botaurus poiciloptilus	Australasian Bittern	E	E	No	Possible. Potential habitat present at the lagoon.	Possible. Potential habitat present at the lagoon.
Ninox connivens	Barking Owl	V		No	Likely. Potential habitat present in larger woodland patches along the route alignment.	Likely. Potential habitat present in larger woodland patches along the route alignment.
Melithreptus gularis gularis	Black-chinned Honeyeater	V		No	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Climacteris picumnus victoriae	Brown Treecreeper	V		No	Likely. Potential habitat	Likely. Potential habitat

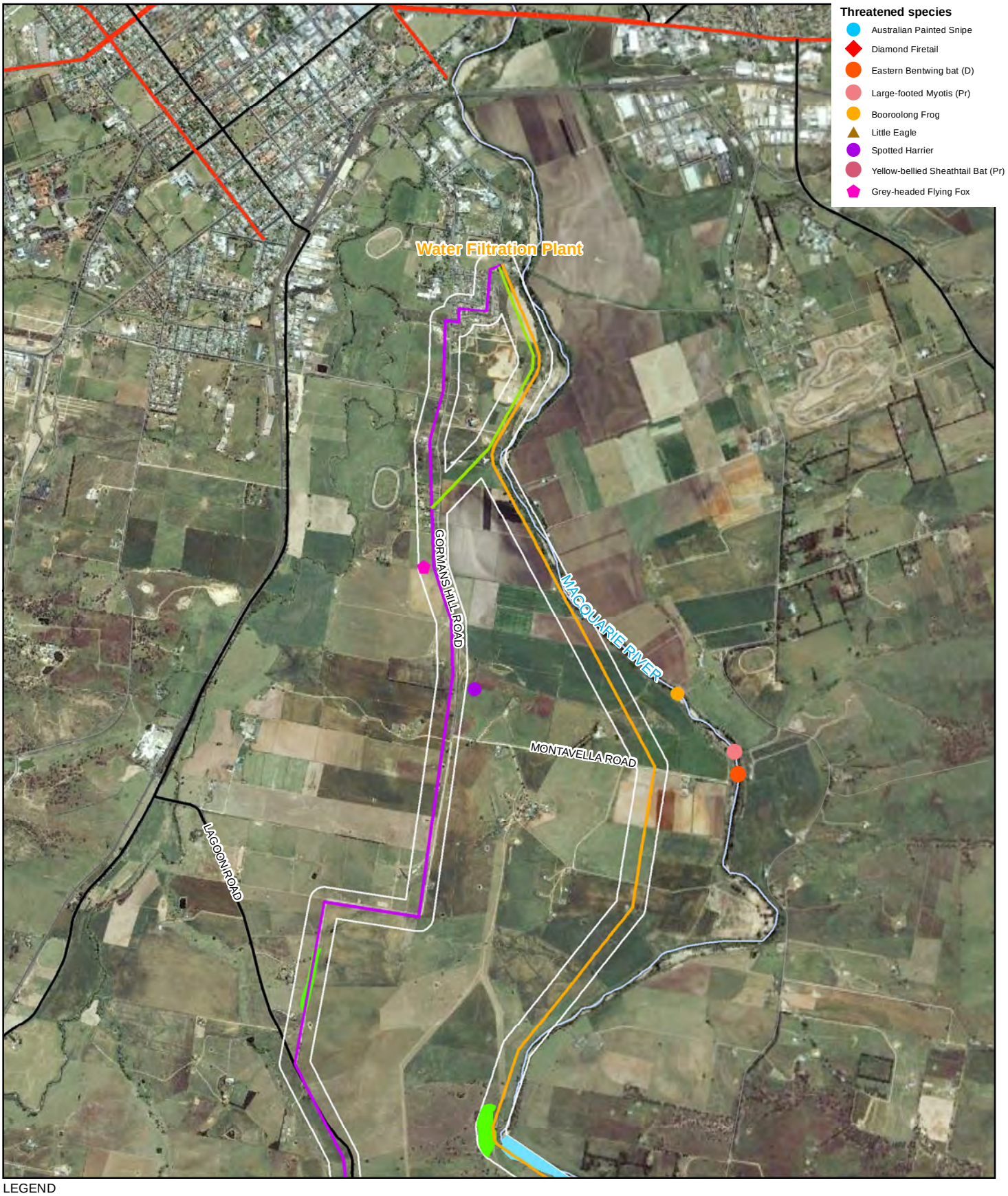
Scientific Name	Common Name	TSC Act	EPBC Act	Recorded during surveys	Likelihood of occurrence* Route 1	Likelihood of occurrence* Route 2
					present in woodland patches along the route alignment.	present in woodland patches along the route alignment.
Stagonopleura guttata	Diamond Firetail	V		Yes	Present. Recorded near Chifley Dam and Bidgeribbin Road. Potential habitat present in woodland patches along the route alignment.	Present. Recorded near Chifley Dam and Bidgeribbin Road. Potential habitat present in woodland patches along the route alignment.
Petroica phoenicea	Flame Robin	V		No	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Stictonetta naevosa	Freckled Duck	V		No	Possible. Could occur on occasion in the lagoon during droughts.	Possible. Could occur on occasion in the lagoon during droughts.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	No	Possible. May occur in woodland patches on occasion, although these are not considered preferred habitat.	Possible. May occur in woodland patches on occasion, although these are not considered preferred habitat.
Melanodryas cucullata cucullata	Hooded Robin	V		No	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Hieraaetus morphnoides	Little Eagle	V		Yes	Recorded near Chifley Dam. Likely to forage throughout woodland patches, and may breed in woodland patches.	Recorded near Chifley Dam. Likely to forage throughout woodland patches, and may breed in woodland patches.
Glossopsitta pusilla	Little Lorikeet	V		No	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.

Scientific Name	Common Name	TSC Act	EPBC Act	Recorded during surveys	Likelihood of occurrence* Route 1	Likelihood of occurrence* Route 2
Limosa limosa	Black-tailed Godwit	V	M	No	Possible. Outside usual range. Could occur at the lagoon on rare occasions.	Possible. Outside usual range. Could occur at the lagoon on rare occasions.
Anseranas semipalmata	Magpie Goose	V		No	Possible. May occur at the lagoon on a transitory basis.	Possible. May occur at the lagoon on a transitory basis.
Anthochaera phrygia	Regent Honeyeater	CE	E	No	Likely. Potential foraging habitat present in woodland patches.	Likely. Potential foraging habitat present in woodland patches.
Petroica boodang	Scarlet Robin	V		No	Likely. Potential foraging habitat present in woodland patches.	Likely. Potential foraging habitat present in woodland patches.
Pyrroholaemus sagittatus	Speckled Warbler	V		No	Likely. Potential foraging habitat present in larger woodland patches.	Likely. Potential foraging habitat present in larger woodland patches.
Circus assimilis	Spotted Harrier	V		Yes	Present. Recorded near Gormans Hill. Could forage throughout the study area. May breed in the study area.	Present. Recorded near Gormans Hill. Could forage throughout the study area. May breed in the study area.
Lophoictinia isura	Square-tailed Kite	V		No	Possible. Could forage and breed in woodlands in the study area, however woodland habitat of low quality for this species.	Possible. Could forage and breed in woodlands in the study area, however woodland habitat of low quality for this species.
Lathamus discolor	Swift Parrot	E	E	No	Possible. Could forage in woodland patches on occasion.	Possible. Could forage in woodland patches on occasion.
Daphoenositta chrysoptera	Varied Sittella	V		No	Likely. Could forage and breed in larger woodland patches in the study area.	Likely. Could forage and breed in larger woodland patches in the study area.
Mammals						
Nyctophilus corbeni (=Nyctophilus timoriensis sp 2	Greater Long-eared Bat	V	V	No	Possible. Could forage and breed in woodland patches	Possible. Could forage and breed in woodland patches

Scientific Name	Common Name	TSC Act	EPBC Act	Recorded during surveys	Likelihood of occurrence* Route 1	Likelihood of occurrence* Route 2
southeastern form)					in the study area.	in the study area.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Yes	Present. Would forage in woodland patches and open areas in the study area. No breeding habitat present.	Present. Would forage in woodland patches and open areas in the study area. No breeding habitat present.
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Possibly	Probably recorded based on echolocation call analysis. Would forage in woodland patches and open areas in the study area. May breed in tree hollows in the study area.	Probably recorded based on echolocation call analysis. Would forage in woodland patches and open areas in the study area. May breed in tree hollows in the study area.
Myotis macropus	Large-footed Myotis	V		Possibly	Probably recorded based on echolocation call analysis. Would forage along rivers and over the freshwater wetland. May breed in tree hollows in the study area.	Probably recorded based on echolocation call analysis. Would forage along rivers and over the freshwater wetland. May breed in tree hollows in the study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Yes	Present. Could forage in woodland patches in the study area on occasion. No breeding habitat present.	Present. Could forage in woodland patches in the study area on occasion. No breeding habitat present.
Phascolarctos cinereus	Koala	V		No	Likely. Likely to forage in larger woodland patches. Main area of habitat lies about 1.5 km to the south-west of The Lagoon.	Likely. Likely to forage in larger woodland patches. Main area of habitat lies about 1.5 km to the south-west of The Lagoon.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	No	Possible. May forage on occasion in the study area.	Possible. May forage on occasion in the study area.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	No	Likely. May occur in woodland patches in the study area.	Likely. May occur in woodland patches in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Recorded during surveys	Likelihood of occurrence* Route 1	Likelihood of occurrence* Route 2
Frogs						
Litoria booroolongensis	Booroolong Frog	E	E	Yes	Likely. Potential habitat present near Chifley Dam.	Recorded at Macquarie River. Potential habitat present near Chifley Dam.
Litoria aurea	Green and Golden Bell Frog	E	V	No	Possible. May occur in farm dams near the alignment. Could forage and disperse in woodland patches.	Possible. May occur in farm dams near the alignment. Could forage and disperse in woodland patches.

* see section 3.3 for definitions of present, likely and possible.



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- Apple Box - Yellow Box woodland - EEC
- Blakely's Red Gum - Yellow Box woodland - EEC
- Planted Blakely's Red Gum - Yellow Box woodland - EEC
- River Oak riparian/forest
- Freshwater Wetland
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 137.5275 550 825 1,100

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Vegetation types and threatened species

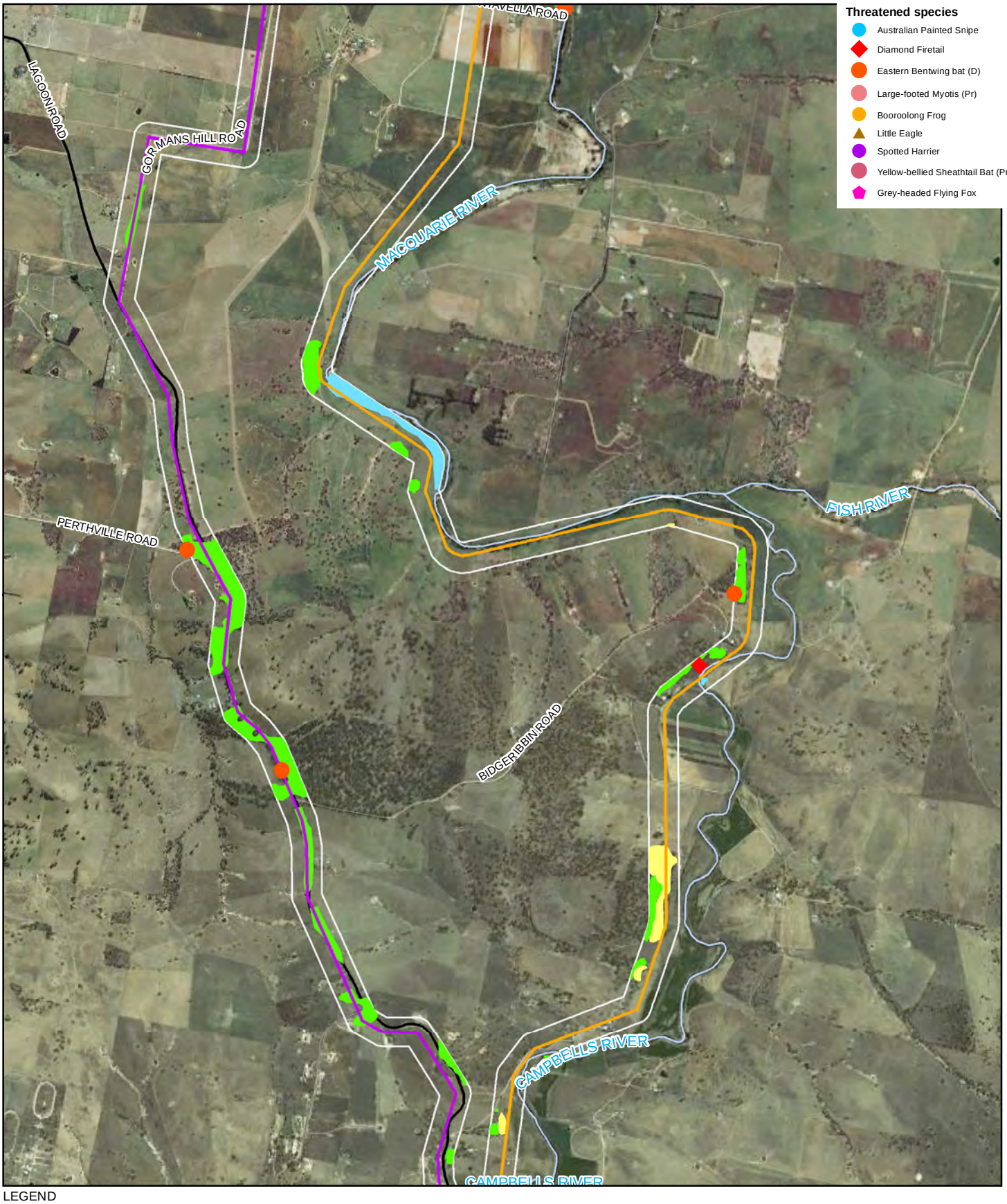
Job Number	21-21844
Revision	2
Date	13 Mar 2013

Figure 4 a

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z012_Vegetation_revised.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- Apple Box - Yellow Box woodland - EEC
- Blakely's Red Gum - Yellow Box woodland - EEC
- Planted Blakely's Red Gum - Yellow Box woodland - EEC
- River Oak riparian/forest
- Freshwater Wetland
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 137.5275 550 825 1,100

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Vegetation types and threatened species

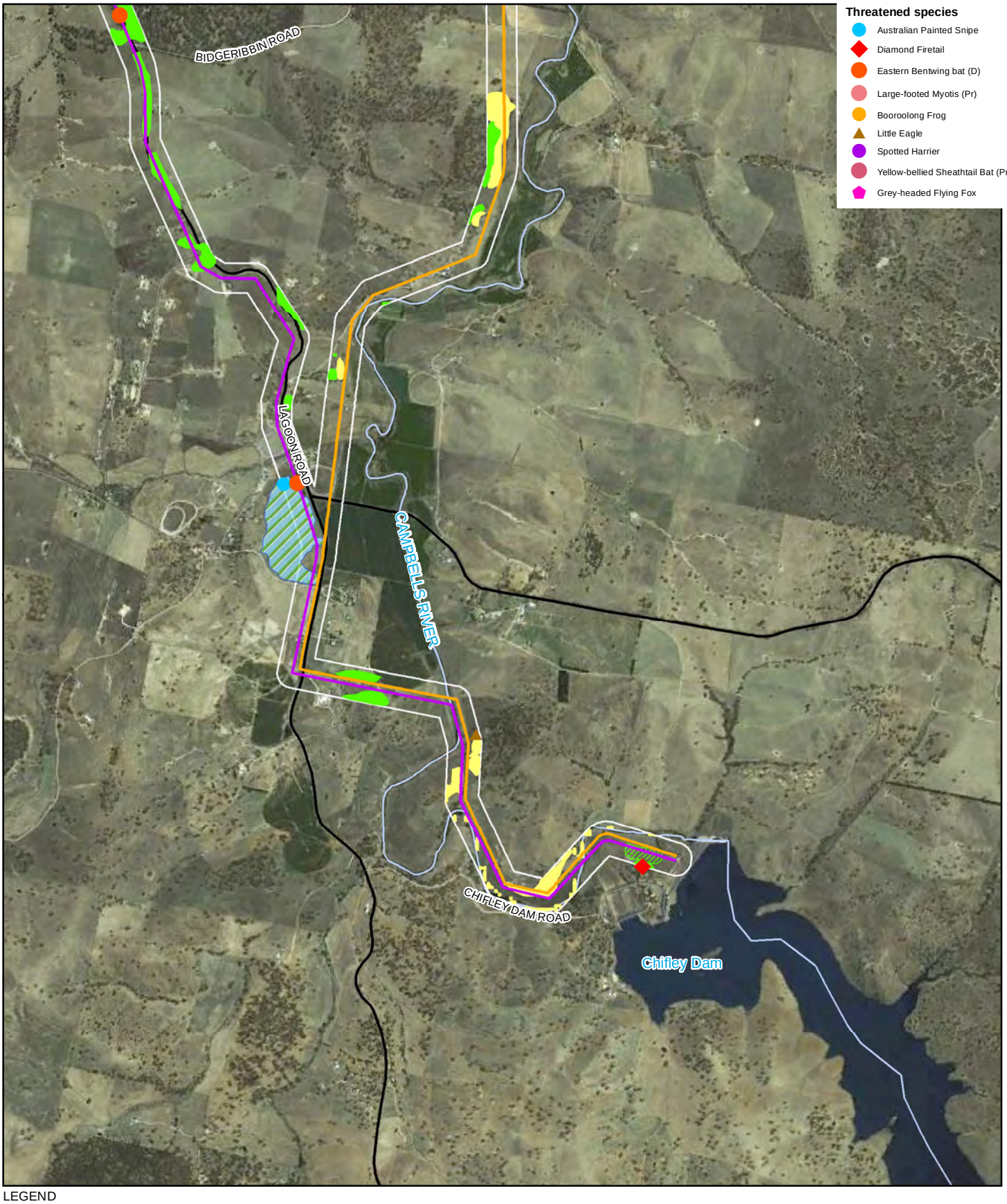
Job Number	21-21844
Revision	2
Date	13 Mar 2013

Figure 4 b

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z012_Vegetation_revised.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- Apple Box - Yellow Box woodland - EEC
- Blakely's Red Gum - Yellow Box woodland - EEC
- Planted Blakely's Red Gum - Yellow Box woodland - EEC
- River Oak riparian/forest
- Freshwater Wetland
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 137.5275 550 825 1,100

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Vegetation types and threatened species

Job Number 21-21844

Revision 2

Date 13 Mar 2013

Figure 4 c

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z012_Vegetation_revised.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson

5. Potential Impacts and Constraints

This chapter details the potential impacts of the pipeline routes, in particular with respect to their possible impact on threatened and migratory biota. A constraints assessment is provided, showing the ecological constraints associated with each of the pipeline routes.

5.1 Preliminary impact assessment

This preliminary impact assessment provides an overview of the potential impacts that may result from the construction of the pipeline.

5.1.1 Introduction

The focus of the preliminary impact assessment is on Route 1 versus Route 2. The ecological difference between Route 1 and the alternate Route 1 is minimal, as both pass through highly modified environments with no native vegetation. The alternate Route 1 is therefore not assessed separately.

Impacts described below are not exact, as there are a number of design details that are yet to be finalised. The pipeline routes as shown are approximate, and some changes in alignment are likely (e.g. the alignment may need to be located further from river banks in some places, and would avoid houses). The type of pipe is yet to be determined, and thus the exact width of the disturbance footprint is not yet known. According to the pre-feasibility assessment (Hydro Tasmania 2008), the possible internal diameter of the pipe may be up to 1200 mm. Surface disturbance will depend on size of the pipe and equipment used for construction. Finally, the method of crossing Campbells River downstream of Chifley Dam has not yet been decided.

The main potential impacts of the proposal relate to the clearing of native vegetation, in particular TECs and related habitat for threatened species. Additional impacts relate to impacts on riparian areas, particularly in regard to disturbance of habitat for threatened frogs. The pipeline also has the potential to indirectly impact areas adjacent to the construction footprint, and cause downstream impacts. As noted previously, this report does not assess impacts on aquatic habitats, except where these impacts relate to terrestrial flora and fauna.

A summary of the total area of each vegetation type present within the 200 m wide route corridors is provided in Table 8. Note that vegetation that would be impacted by the proposal would be considerably less than these values, as the pipeline is likely to impact a corridor up to about 10 m wide. Potential impacts are discussed in more detail below, with respect to the two main route options.

Table 8 Vegetation areas in the pipeline corridors

Vegetation type		Route 1 Area (ha)	Route 1 Alternative Area (ha)	Route 2 Area (ha)
1	Apple Box - Yellow Box - Mountain Gum open-woodland on flats and low hills of the central tablelands	8.55	8.55	16.03
2	Blakely's Red Gum - Yellow Box open-woodland of the tablelands	36.27	36.27	15.09
3	River Oak riparian woodland/forest of the slopes and tablelands	0.00	0.00	7.53

Vegetation type		Route 1 Area (ha)	Route 1 Alternative Area (ha)	Route 2 Area (ha)
4	Planted Blakely's Red Gum - Yellow Box open-woodland of the tablelands	2.11	2.11	2.11
5	Freshwater wetland	7.20	7.20	2.16
6	Agricultural/cleared Land	326.87	325.90	374.83
	TOTAL	373.80	372.84	417.75
	Total Box-gum woodland EEC (veg type 1+2)	44.82	44.82	31.12
	Percentage of the study area that is EEC	12.00%	12.02%	7.45%
	Percentage of the study area that is native vegetation	14.48%	14.52%	10.28%

5.1.2 Common Alignment (Route 1 and 2): Chifley Dam to Lagoon Road

Between Chifley Dam and Lagoon Road, Route 1 and Route 2 follow the same alignment. The alignment is located in paddocks until it meets Lagoon Road about 2 km to the northwest of Chifley Dam. This alignment would cross Campbells River in two locations. Potential impacts of this alignment are described below.

River crossings

At the first crossing, the river bed has areas of exposed cobbles and pebbles, which are potential habitat for the Booroolong Frog (listed as endangered under the TSC Act and the EPBC Act). This species was recorded in the Macquarie River near Bathurst in similar habitat. The impact of the proposal on Booroolong Frog habitat would depend on the method of crossing the river. Trenching would cause high levels of disturbance, while directional drilling would have negligible impact on this area.

At the second crossing location, river banks are steep-sided alluvium, and may contain Platypus burrows. Construction of the pipeline in this location may impact on burrows. While the Platypus is not listed as threatened, efforts should be made to limit impacts on the species and its habitat. Construction of river crossing points would have little or no impact on native vegetation.

Agricultural areas

In agricultural land, the pipeline is likely to be able to be aligned to generally avoid native vegetation. Small patches of Apple Box - Yellow Box - Mountain Gum open-woodland (Box-gum woodland EEC) are located between the two crossings of Campbells River, and the pipeline is likely to be able to be aligned to the edges of these, making removal of trees unlikely. A total of 5.84 ha of this community is present in the pipeline corridor between Chifley Dam and Lagoon Road, although much of this is located on the hills above the southern bank of Campbells River, while the pipeline would be positioned on the northern bank. Assuming a corridor of about 10 m wide, up to 0.29 ha of this community may be impacted, with most impacts being temporary. The disturbance of groundcover would have a minor impact on the remnant Apple Box - Yellow Box - Mountain Gum open-woodland (Box-gum woodland EEC), as few native species are present. Groundcover would likely be rehabilitated following construction. There is unlikely to be any impact on threatened species, assuming no trees are removed. If trees do require removal, this may have a minor impact on foraging habitat for threatened woodland birds, such as the Diamond Firetail, listed as vulnerable under the TSC Act, which was recorded near Chifley Dam. Some groundcover would be disturbed. The construction of the pipeline may also disturb lightly embedded surface rock in this area. Threatened grassland reptiles are considered unlikely to occur in this area, due to the low incidence of native grasses and surface rock, and

lack of recent records. If present, impacts on these species would be minor due to the very small area that would be temporarily disturbed.

Freshwater wetland

A freshwater wetland is present at The Lagoon, adjacent to the road reserve. This is an ephemeral wetland, and water levels depend on recent rain. The road passes quite close to the wetland, and construction of the pipeline may involve the temporary clearing of reeds and disturbance of the water table at the perimeter of the wetland (particularly if constructed on the western side of the road). Indirect impacts such as sedimentation and erosion, and introduction of pollutants are also possible. A wide range of water birds were recorded at the wetland, including the endangered Australian Painted Snipe and the migratory Latham's Snipe. A number of other threatened and migratory water birds may use the wetland on occasion. Most are unlikely to breed, however it is possible that the Australian Painted Snipe could breed at the wetland. The proposal is unlikely to directly impact breeding habitat, however may impact a small area of foraging habitat for this species, and foraging habitat for a range of other water birds. The lagoon also represents potential habitat for the Green and Golden Bell Frog, although there are no historical records at this location, and the species may be extinct in the LGA (most recent confirmed record is from 1973). A range of microbats are likely to forage over the lagoon. The construction of the pipeline is unlikely to impact this foraging habitat.

5.1.3 Route 1: Lagoon Road to the Water Treatment Plant

Route 1 is predominantly located in the road reserve of The Lagoon Road and Gormans Hill Road. Near the Water Filtration Plant the pipeline would either follow road alignments, or branch off to follow the river alignment (Alternate Route 1) in an area of open paddocks.

Cleared road reserves

Much of the road reserve is cleared of native vegetation, except for occasional scattered trees. No native derived grassland is present. Construction of the pipeline would have negligible impacts on threatened biota. The Spotted Harrier, which is listed as a vulnerable species under the TSC Act, was recorded hunting in open country, including over a road reserve. The road reserve would make up only a very small portion of the foraging habitat of this species.

Woodland in road reserves

A number of patches of Blakely's Red Gum - Yellow Box open-woodland are present in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. In these areas, the construction of the pipeline is likely to require the removal of a number of trees, including hollow-bearing trees. Vegetation along the road reserve corresponds to Box-gum woodland, listed as an endangered ecological community under the TSC Act. No areas of Box-gum woodland found within the study area meet the criteria for the critically endangered ecological community as listed under the EPBC Act. A total of 36.27 ha of this community occur in the 200 m wide pipeline corridor. Assuming a 10 m wide disturbance footprint, the pipeline could impact up to about 1.8 ha of the Box-gum woodland EEC (although this is likely to be an overestimate). Based on hollow-bearing tree transects undertaken in these areas, a number of hollow-bearing trees would need to be removed. The number of trees to be removed will depend on the side of the road the alignment would be on, and whether the road reserve is wide enough in these areas to allow for avoidance of some of the trees.

Woodland in the road reserves provides potential habitat for a range of threatened fauna species. In particular, these include a number of small woodland birds such as the Diamond Firetail listed as vulnerable under the TSC Act, and the Koala, listed under both the TSC Act and the EPBC Act as a vulnerable species. Hollow-bearing trees may be used as roost sites by

a number of threatened microbat species. Clearing of trees would generally not interfere with wildlife connectivity for arboreal fauna such as the Koala, as woodland patches in the road reserve are either adjacent to larger patches in paddocks, or are isolated and currently not part of a wildlife corridor.

5.1.4 Route 2: Lagoon Road to the Water Treatment Plant

Route 2 generally follows the alignment of Campbells River and the Macquarie River between Lagoon Road and the WFP.

Open paddocks

Much of the alignment of Route 2 is cleared of native vegetation, except for occasional scattered trees. Paddocks vary between cultivated crops and grazing land. No native derived grassland is present. Construction of the pipeline would have negligible impact on threatened biota. The Spotted Harrier, which is listed as a vulnerable species under the TSC Act, was recorded hunting in open country, including over cultivated crops and paddocks. The road reserve would make up only a very small portion of the foraging habitat of this species. Very few areas of lightly embedded surface rock were observed. It is unlikely that threatened grassland reptiles would occur in these areas, due to the lack of rocky habitat, the lack of native grasses, and the high levels of disturbance.

Woodland patches

In some locations Route 2 passes through or adjacent to patches of Apple Box - Yellow Box - Mountain Gum open-woodland and Blakely's Red Gum - Yellow Box open-woodland (both part of the Box-gum woodland EEC). A total of 25.28 ha of Box-gum woodland is present in the pipeline corridor. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid impacting on trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to contain the footprint. At this location there are some very large trees with hollows, however it is likely that the proposal would avoid clearing these trees. At most, the pipeline may impact 1.2 ha, although this is likely to be an overestimate.

As discussed above, woodland patches provide potential habitat for a range of threatened fauna species. In particular, these include a number of small woodland birds listed under the TSC Act such as the Diamond Firetail, and the Koala, listed under both the TSC Act and the EPBC Act. Hollow-bearing trees may be used as roost sites by a number of threatened microbat species.

Clearing of trees would generally not interfere with wildlife connectivity for arboreal fauna such as the Koala, as Route 2 generally skirts around the edges of woodland patches, and thus any clearing would be from the edge of a patch of vegetation.

River edges

In some locations Route 2 passes close to the top of the bank of Campbells River or the Macquarie River. It is assumed that the final design will include an appropriate set-back from the rivers to avoid destabilising banks or causing other direct and indirect impacts on riparian vegetation or fauna habitats from construction.

5.2 Impacts on threatened biota

Preliminary assessments of significance have been prepared for key threatened biota listed under the TSC Act and key threatened and migratory biota listed under the EPBC Act that may be impacted by the proposed pipeline.). A comparison of impacts has been provided for the two routes for each assessment of significance.

5.2.1 Impacts on threatened biota listed under the TSC Act

Preliminary assessments of significance for key threatened biota listed under the TSC Act (see Appendix D) have been provided for:

- Box-gum Woodland.
- The Booroolong Frog, listed as endangered under the TSC Act.
- The Australian Painted Snipe, listed as endangered under the TSC Act.
- Woodland birds (e.g. the Diamond Firetail), listed as vulnerable under the TSC Act.
- The Koala, listed as vulnerable under the TSC Act.
- All recorded hollow-dependent bats, listed as vulnerable under the TSC Act.

Assessments of significance have not been prepared for the Spotted Harrier, Little Eagle, Grey-headed Flying-fox, Eastern Bentwing Bat and Eastern Cave Bat as these are wide-ranging species, and the proposal would have minimal impact on foraging and/or breeding habitat for these species. Assessments of significance would be required for these species and other species that are likely to occur when the impact assessment for the preferred route is prepared.

Impacts of the proposal will depend on the final route, and method of crossing Campbells River (i.e. directional drilling or trenching). Assuming that directional drilling is used, the proposal is unlikely to significantly impact threatened biota. The proposal could possibly result in a significant impact on the Booroolong Frog if Campbells River is trenched and the species is found to be resident at this location. A Species Impact Statement would be required if the proposal is likely to have a significant impact on this species.

5.2.2 Impacts on threatened biota listed under the EPBC Act

Preliminary assessments of significance for key threatened biota listed under the EPBC Act (see Appendix E) have been provided for:

- The Booroolong Frog, listed as endangered under the EPBC Act.
- The Australian Painted Snipe, listed as vulnerable under the EPBC Act.
- The Koala, listed as vulnerable under the EPBC Act.

As discussed above, impacts of the proposal will depend on the final route. The proposal is unlikely to significantly impact threatened biota unless trenching is used for the Campbells River crossing, in which case there is a possibility that the proposal could significantly impact the Booroolong Frog. The proposal would need to be referred to the Minister for Sustainability, Environment, Water, Population and Communities if the proposal is likely to have a significant impact on this species.

5.2.3 Impacts on migratory biota listed under the EPBC Act

Three migratory species listed under the EPBC Act were recorded in the study area. No individual assessments of significance pursuant to the EPBC Act Significant Impact Guidelines (DEWHA 2009) have been prepared for migratory species as:

- The habitats recorded within the study area do not qualify as 'important habitat' for migratory species as defined under the guidelines.
- There is no real chance or possibility that the proposal will substantially modify, destroy or isolate an area of important habitat for migratory species.
- The proposal would not result in an invasive species (that is harmful to the migratory species) becoming established in an area of important habitat for migratory species.
- The proposal is not likely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

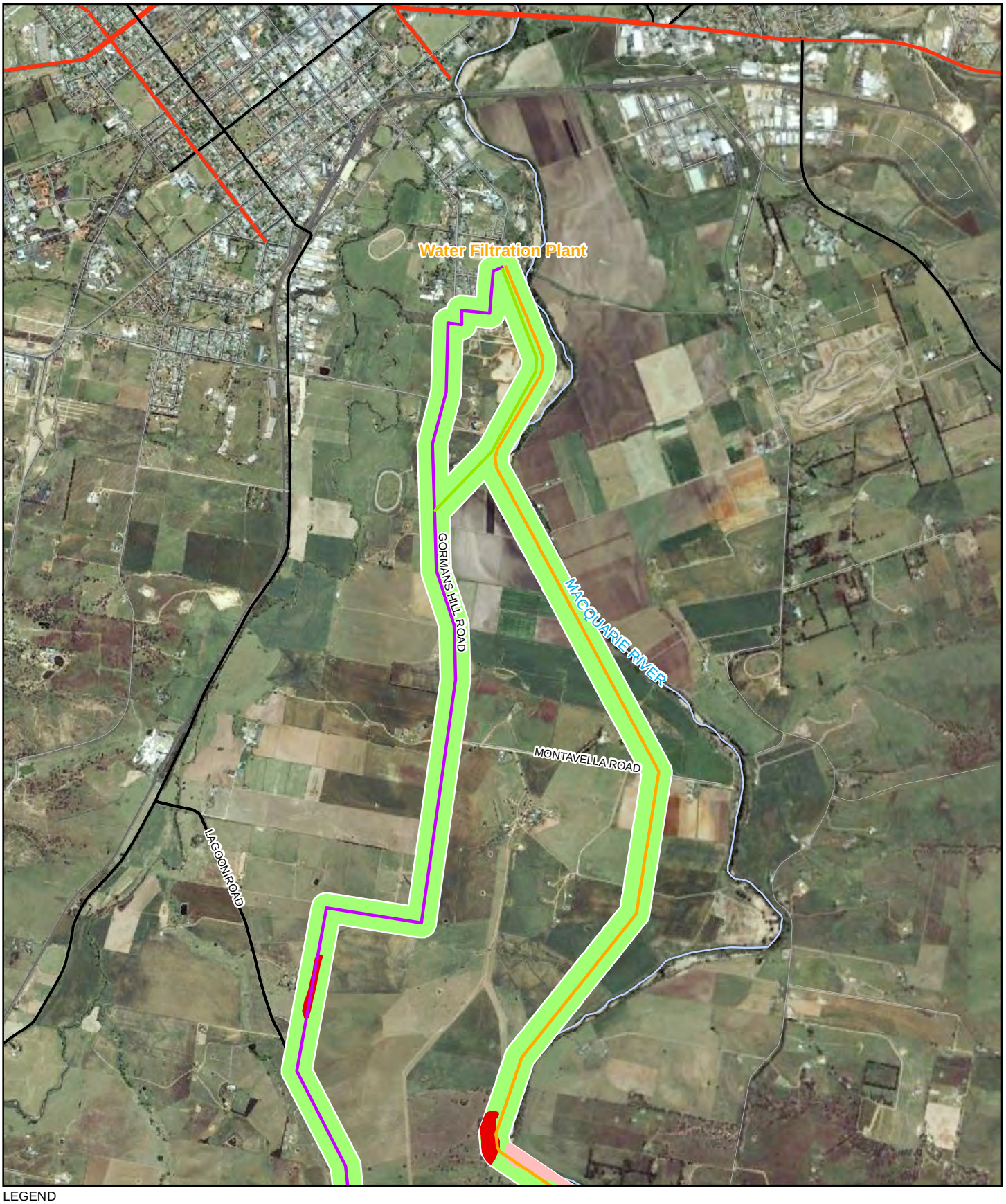
Based on the above considerations the proposal is unlikely to impose "a significant effect" on any of the listed migratory fauna species predicted to occur within the locality.

5.3 Constraints assessment

Ecological constraints were identified for the three alignment options. These are based particularly on vegetation type and status, and presence of known or potential habitat for threatened flora and fauna (see Table 9). Ecological constraints of the two routes (and the alternate route 1) are mapped in Figure 5.

Table 9 Ecological constraint classes

Constraint Class	Description
Low	Cleared agricultural land or road reserve. Minimal habitat for threatened and migratory biota.
Moderate	Native vegetation not a threatened community. Good habitat for threatened and migratory biota.
High	Threatened ecological community. Good habitat for threatened and migratory biota.



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- High constraint
- Moderate constraint
- Low constraint
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 125 250 500 750 1,000

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

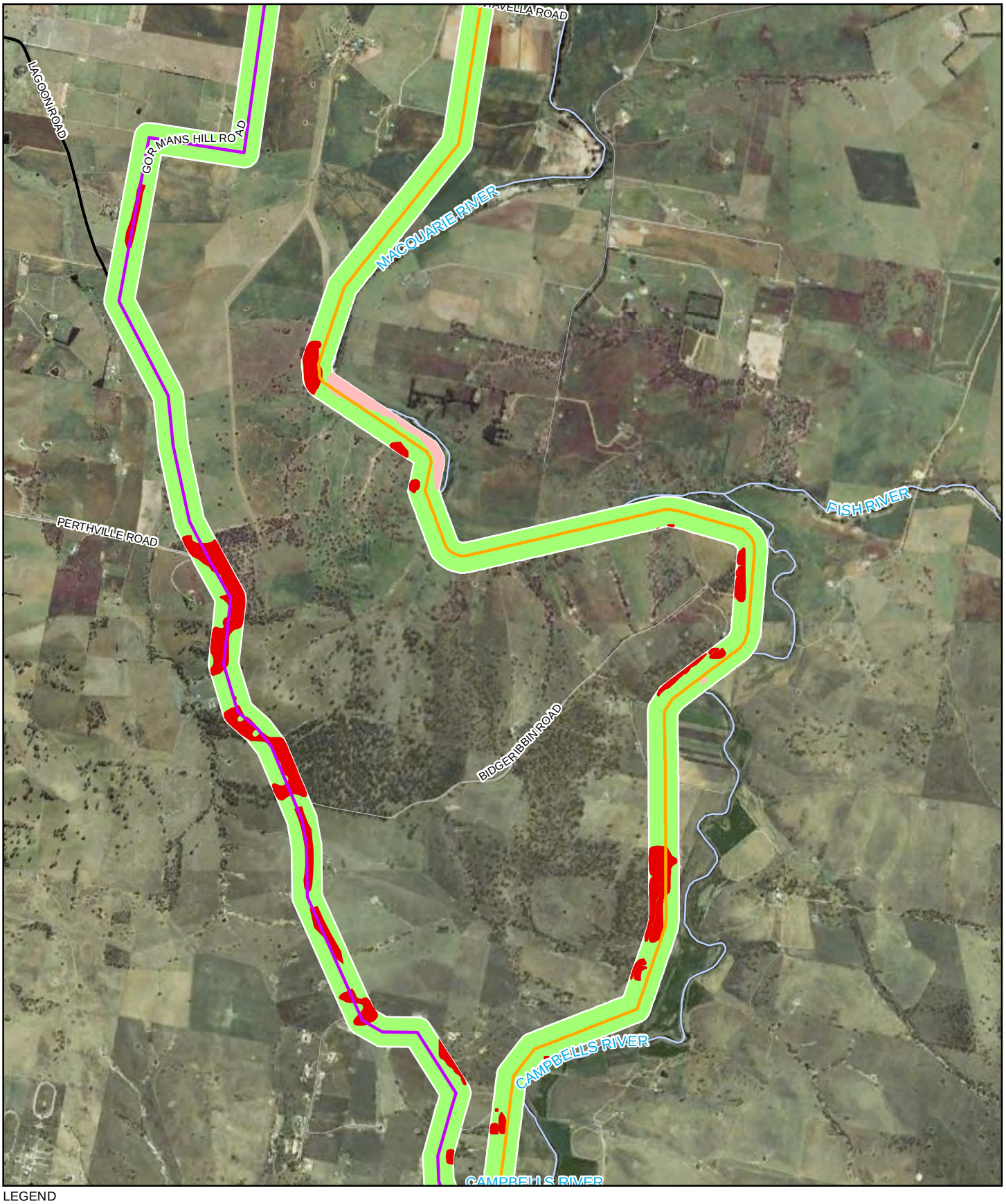
Job Number	21-21844
Revision	2
Date	14 Mar 2013

Ecological constraints Figure 5 a

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z011_Ecological Constraints.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- High constraint
- Moderate constraint
- Low constraint
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 125 250 500 750 1,000

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

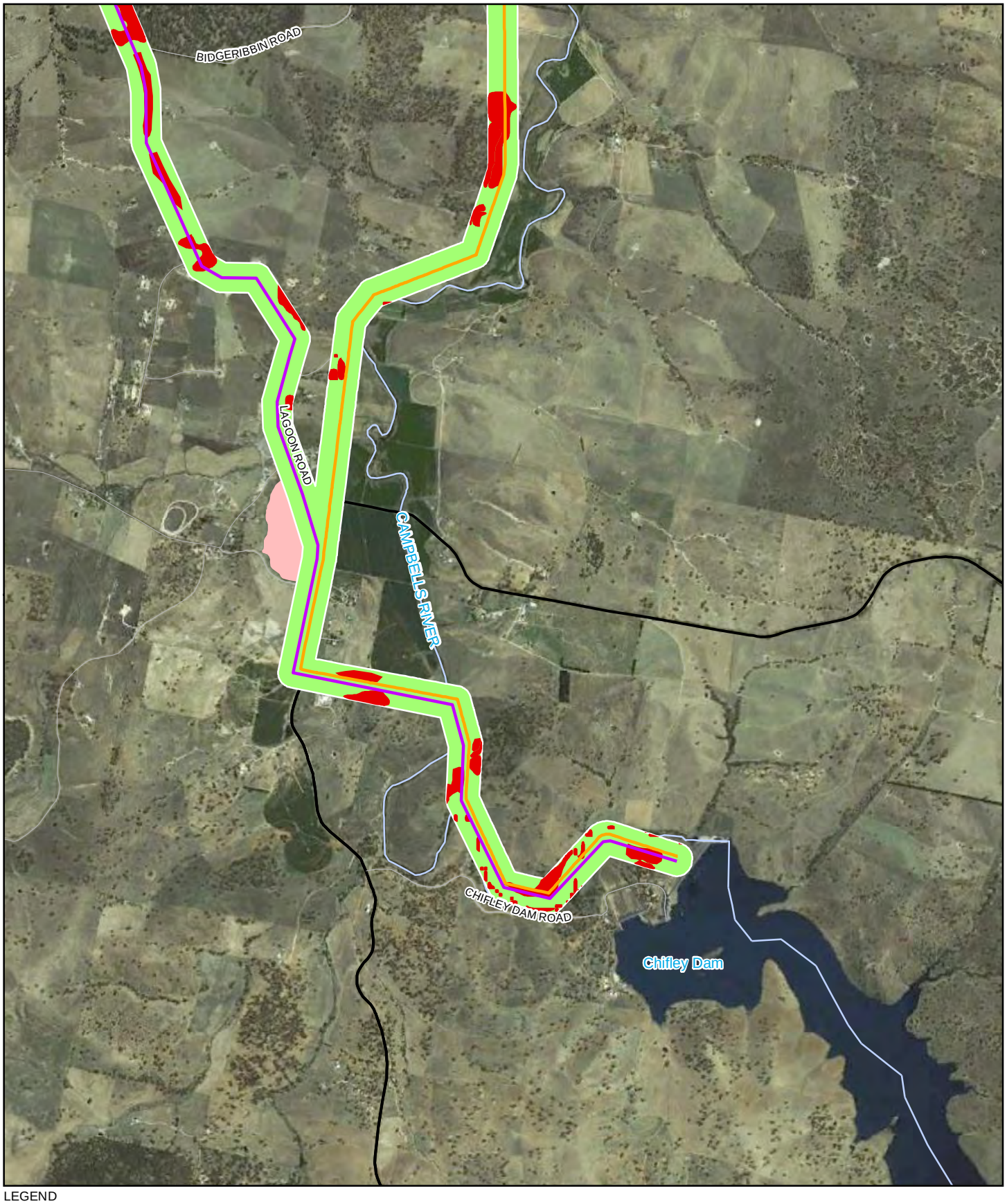
Job Number	21-21844
Revision	2
Date	14 Mar 2013

Ecological constraints Figure 5 b

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z011_Ecological Constraints.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson



LEGEND

- Route 1 - Alternate
- Route 1
- Route 2
- High constraint
- Moderate constraint
- Low constraint
- Highways
- Major Roads
- Secondary Roads
- Other Roads
- Watercourse

1:35,000 (at A4)

0 125 250 500 750 1,000

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

Bathurst Regional Council

Chifley Dam Pipelines

Job Number	21-21844
Revision	2
Date	14 Mar 2013

Ecological constraints Figure 5 c

N:\AU\Sydney\Projects\21\21844\GIS\Maps\MXD\21_21844_Z011_Ecological Constraints.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: NSW Department of Lands: Cadastre - Jan 2011; Geoscience Australia: 250k Data - Jan 2011; Google Earth Pro: Imagery, Accessed: November, 2012. Created by:cwilson

6. Recommendations for Mitigation and Monitoring

This chapter details measures recommended for mitigation of impacts, according to the heirachy of avoid, minimise and mitigate. In addition, recommendations for further surveys and possible monitoring programs are provided.

6.1 Mitigation of impacts

The general principle to minimise impacts to biodiversity, should in order of consideration, endeavour to:

- Avoid impacts on habitat, through the planning process
- Minimise impacts on habitat, through the planning process.
- Mitigate impacts on habitat, though the use of a range of mitigation measures.
- Offset any residual impacts that cannot be mitigated for.

These are discussed in more detail below.

6.1.1 Avoidance of impacts

The avoidance of impacts can be achieved through the planning process. This process involves a preliminary examination of a number of possible route options and their potential impacts on the environment and other factors (for example, economic and social considerations). Those potential routes that best fit the environmental, social and economic criteria are then short-listed. This study is part of this process to avoid impacts.

The two route options are located in a largely modified environment for much of their length. As such, the proposal will be able to avoid impacts on native biodiversity values for most of the routes. Further avoidance of impacts can be made during design of the preferred route, if the following recommendations are taken on board:

- Common alignment of Route 1 and 2:
    - Use directional drilling under Campbells River to avoid impacts on riparian habitat, potential Booroolong Frog habitat and potential Platypus burrows.
    - Align pipeline to avoid removal of trees where the pipeline route passes close to or through woodland patches.

6.1.2 Minimising impacts

Following selection of the preferred route, impacts can be minimised during the detailed design process as follows:

- Route 1:
    - Align the pipeline route within the road reserve to minimise removal of trees where possible. This would include moving to the opposite side of the road in places, or limiting the disturbance footprint to the smallest area necessary.
- Route 2:
    - Align the pipeline away from the river banks to minimise impacts on riparian areas,

- Align the pipeline to avoid woodland patches by following existing easements and access tracks.

6.1.3 Mitigation of impacts

Despite efforts to avoid native vegetation, the proposal is likely to impact native vegetation communities and fauna habitats in some areas. In order to minimise the potential impacts of the project on biodiversity, the mitigation measures outlined in Table 10 are recommended.

Table 10 Recommended mitigation measures

Impact	Mitigation
General	• Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site and protection measures to be implemented to protect biodiversity. • A Construction Environmental Management Plan (CEMP) and project environmental management plan would be developed following approval of the proposal. This should include the preparation of a Flora and Fauna Management Sub-plan (FFMP) which would include items below.
Vegetation	• Construction vehicles should be washed prior to commencement of work on the proposal to minimise the spread of weeds and diseases. • Vegetation to be retained should be fenced off from the construction footprint to avoid additional impacts on vegetation. • Restriction of stockpiles of construction materials, fill or vegetation to existing cleared areas and not within areas of adjoining native vegetation. • Groundcover in patches of Box-gum Woodland should be rehabilitated with locally sourced seed of appropriate groundcover species. • Wetland vegetation at the freshwater wetland would be rehabilitated following construction.
Fauna habitat	• Any hollow-bearing trees to be removed must be felled in accordance with a tree-felling and fauna rescue procedure to be detailed in the FFMP. • Habitat features such as hollow logs and branches within the disturbance footprint would be salvaged and relocated to adjoining vegetation. • A Wombat burrow and Platypus burrow removal procedure may be required for inclusion in the FFMP. • Pre-clearing surveys would be required for the Booroolong Frog if the pipeline is to be trenched across Campbells River. • Avoid undertaking construction activities at the freshwater wetland during the breeding season of the Australian Painted Snipe (generally August to March, although can vary depending on wetland conditions). • Ensure water levels are not negatively impacted by lowering outlets.
Water quality	• Erosion and sediment controls should be implemented in accordance with Volume 2D of Managing Urban Stormwater: soils and construction (DECC 2008). • All stockpiled material would be stored in bunded areas and kept away

Impact	Mitigation
	from waterways to avoid sediment entering the waterway. • Water should be applied to stockpile areas during windy conditions. • Surfaces should be stabilised as quickly as practicable after construction.

6.2 Recommendations for future surveys

Future surveys would be required for the preferred route when Council is ready to undertake the impact assessment as part of the approval process. The following surveys are recommended:

- Detailed vegetation boundary mapping along the final route.
- Vegetation surveys in woodland patches along the preferred route that were not accessed during these surveys (e.g. land east of Campbells River).
- Targeted searches for *Euphrasia arguta* at the Freshwater Wetland and *Lepidium hyssopifolium* in woodland along the preferred route footprint.
- Mapping of hollow-bearing trees that would be removed along the final pipeline alignment.
- Additional nocturnal surveys for the Barking Owl if hollow-bearing trees are to be removed. This may include stagwatching and call playback to identify potential nest sites of the spceies. The existing draft survey guidelines (DEC 2004) recommends at least five nights of survey for this species.
- Additional diurnal bird surveys, particularly for hollow-dependent threatened birds if hollow-bearing trees are to be removed. This would assist with identifying if any trees are being used for nesting in.
- Identification of Common Wombat burrows that would be directly impacted by the preferred pipeline route (for assessment of whether mitigation measures would be required for this species during construction).
- Identification of whether Platypus burrows would be directly impacted by the two crossings of Campbells River (for assessment of whether mitigation measures would be required for this species during construction).
- Further survey for the Booroolong Frog at pebbled riverbanks on Campbells River near Chifley Dam and the proposed crossing location if the crossing is to be trenched. Further survey along the Macquarie River would also be beneficial in determining the extent of potential habitat for this species, and the distribution of the population.
- Further survey to determine whether any woodland in the study area constitutes core Koala habitat.

Note that if there is a long delay between this assessment and assessment of the preferred route, OEH may require supplementary surveys to target any newly-listed species of relevance and to update existing information given the lapse of time.

6.3 Potential future monitoring locations

As part of this study, Council is interested in identifying if the biodiversity values of any locations should be monitored. As discussed in Sections 4.3.1 and 5.3, much of the study area is cleared agricultural land and represents only low ecological constraints, and there is little to monitor. Only small patches of native vegetation occur in the study area. Given the highly modified and disturbed nature of the study area, and the generally low and temporary anticipated impact of

the proposal on native vegetation, little or no monitoring is likely to be required as part of a future approval process.

Some areas of sensitive threatened fauna habitat are present, in particular the rocky riverbanks where the endangered Booroolong Frog was recorded or could occur, the freshwater wetland at The Lagoon, where the endangered Australian Painted Snipe and the migratory Latham's Snipe were recorded, and patches of the endangered Box-gum Woodland. These species and/or habitats could be monitored from a general biodiversity point of view, as long as a monitoring program has a particular purpose and does not further disturb habitat for these species or community.

Monitoring of potential Booroolong Frog habitat could be undertaken at Campbells River if the proposal is to be trenched across the river west of Chifley Dam, and if the species is found to be present at this location during further surveys.

Monitoring of waders, including any threatened or migratory species, could be undertaken at the freshwater wetland. Note that the Australian Painted Snipe was recorded where shelter was provided by the noxious weed Blackberry.While this weed species should generally be removed, no removal of this weed should be undertaken unless in consultation with an expert in the breeding biology of the Australian Painted Snipe. In addition, water quality at the freshwater wetland could be monitored.

Monitoring of the impact of construction on patches of Box-gum woodland EEC could be undertaken. Ground cover in all Box-gum Woodland patches assessed as part of this study area is highly disturbed and has only a low diversity of native flora species. There are high levels of invasion of environmental weeds (mainly pasture species) in all patches. Most patches show signs of stress, including presence of mistletoe, borers, dieback and senescence of trees. Without significant bush regeneration effort, it is likely that some patches will have significant dieback over the next three decades or so. Many of these are, however, located in grazing land, and bush regeneration is not feasible unless landowners are interested in excluding cattle and setting aside land for conservation purposes. Rehabilitation of patches in Council-owned land could be considered.

Possible monitoring programs are provided in Table 11.

Table 11 Potential monitoring programs

Subject	Description	Actions	Timing
Booroolong Frog	Monitoring of potential Booroolong Frog habitat could be undertaken at Campbells River if the proposal is to be trenched across the river west of Chifley Dam. Monitoring would identify any changes in habitat and population, and provide recommendations to ensure the species persists in the area (if present).	Undertake surveys for the species in cobble areas in the vicinity of the Campbell's River crossing.	Prior to construction
		Monitor habitat extent and condition	During and following construction
		Monitor frog population (if present)	During and following construction
Waders	Monitoring of waders, including any threatened or migratory species, could be undertaken at the freshwater wetland. This could be undertaken before, during and after construction to determine if the proposal impacts habitats or local populations, and whether any remediation work would	Monitoring of wader diversity and abundance	Before, during and after construction

	be required.		
Freshwater wetland	Water quality at the freshwater wetland could be monitored before, during and after construction. This would identify any changes in water quality, and whether any remediation work would be required	Monitoring of water quality	Before, during and after construction
Box-gum Woodland	Monitoring of the impact of construction on patches of Box-gum woodland EEC could be undertaken before and after construction. Some baseline data is provided in the quadrat data collected during these surveys. Rehabilitation of groundcover is recommended where the pipeline would pass through woodland patches. Monitoring would assess the results of rehabilition, and whether any remediation would be required.	Undertake baseline surveys	Prior to construction
		Rehabilitate groundcover	Immediately following construction
		Monitor condition	Following construction

7. Conclusion

This Terrestrial Flora and Fauna Study has focussed on identifying biodiversity values present in the two pipeline corridors (and the Alternate Route 1) and their related ecological constraints.

Biodiversity values identified in or near the study area include:

- Box-gum woodland endangered ecological community (as listed under the TSC Act only)
- Up to ten threatened fauna species:
    - Booroolong Frog (endangered under the TSC Act and the EPBC Act).
    - Australian Painted Snipe (endangered under the TSC Act and the EPBC Act).
    - Diamond Firetail (vulnerable under the TSC Act).
    - Spotted Harrier (vulnerable under the TSC Act).
    - Little Eagle (vulnerable under the TSC Act).
    - Grey-headed Flying-fox (vulnerable under the TSC Act and the EPBC Act).
    - Eastern Bentwing Bat (vulnerable under the TSC Act).
    - Probably the Yellow-bellied Sheathtail Bat, Large-footed Myotis and Eastern Cave Bat (vulnerable under the TSC Act).
- Three migratory species:
    - Australian Painted Snipe.
    - Latham's Snipe.
    - Rainbow Bee-eater.
- Potential habitat for a number of additional threatened fauna species.

Based on a constraints assessment, Route 2 is likely to result in less impact on biodiversity values, including habitat for threatened biota. Alignment of the various routes through largely cleared paddocks and road reserves has avoided biodiversity values to a large extent. Route 2 is preferred due to the following:

- Route 1 has 44.82 ha of Box-gum Woodland present in the pipeline corridor (about 12% of the route corridor is this vegetation type), while Route 2 has 31.12 ha of Box-gum Woodland (about 7.5% of the route corridor).
- Native vegetation makes up about 14.5% of the corridor for Route 1, but only about 10.3% of the corridor for Route 2.
- There is more opportunity to avoid impacts on native vegetation and hollow-bearing trees by going around vegetation patches or using existing easements and access tracks along Route 2, whereas Route 1 is restricted to the road reserve.

Both routes have the potential to impact on potential Booroolong Frog habitat at the Campbells River crossing if the pipeline crossing is trenched rather than using directional drilling. Further surveys are recommended at this location to determine whether the species is present.

Preliminary assessments of significance have been prepared to compare the impacts of the route options. These would need to be reassessed once a preferred route is decided on and to accommodate any design elements incorporated to further mitigate impacts. The method of crossing Campbells River (both routes) may significantly impact the Booroolong Frog if the pipeline is trenched rather than directionally drilled. A Species Impact Statement and an EPBC

Act referral would be required if the proposal is likely to have a significant impact on the Booroolong Frog. No other threatened biota is likely to be significantly impacted by either route.

A number of mitigation measures are recommended in this study to minimise impacts on biodiversity values and habitat for threatened biota. These include avoiding the loss of vegetation and hollow-bearing trees where possible through changing alignment of the preferred route during detailed design, and using directional drilling rather than trenching for the Campbells River crossing.

8. References

BOM (2012). http://www.bom.gov.au/climate/dwo/IDCJDW2012.latest.shtml

Churchill, S. (2008). Australian Bats. Second Edition. Allen & Unwin, Australia.

DEC (2004). Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft. Department of Environment and Conservation.

DEC (2005). Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) Recovery Plan. Department of Environment and Conservation. http://www.environment.nsw.gov.au/resources/nature/recoveryplanGreenGoldBellFrogDraft.pdf

DEC (2006). Reconstructed and Extant Distribution of Native Vegetation in the Central West Catchment. Department of Environment and Conservation, Dubbo.

NSW Scientific Committee (2002) White box yellow box Blakelys Red Gum woodland - Endangered ecological community determination - final. DEC (NSW), Sydney.

DEC (2004), Threatened Biodiversity Survey and assessment: Guidelines for Developments and Activities. Working Draft, Department of Environment and Climate Change (NSW).

DEC/DPI (2005) Draft Guidelines for Threatened Species Assessment, Department of Environment and Climate Change (NSW).

DEC (2006) Identification Guidelines for Endangered Ecological Communities - White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland), Department of Environment and Climate Change (NSW).

DECC (2008) NSW Scientific Committee Final Determination: White Box Yellow Box Blakely's Red Gum Woodland. http://www.environment.nsw.gov.au/determinations/BoxgumWoodlandEndComListing.htm

DECC (2008b). Recovery plan for the Koala (*Phascolarctos cinereus*). Department of Environment and Climate Change http://www.environment.nsw.gov.au/resources/threatenedspecies/08450krp.pdf

DEH (2006a). *EPBC Act – Policy Statement - White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community*. Department of Environment, and Heritage Canberra.

DEW DEH (2006b). *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List*. Department of Environment, and Heritage Canberra.

DEWHA (2009). Significant Impact Guidelines 1.1: Matters of National Environmental Significance. http://www.environment.gov.au/epbc/publications/pubs/nes-guidelines.pdf Department of the Environment, Water, Heritage and the Arts.

DSEWPaC (2012a). EPBC Online Protected Matters Search Tool. Department of Sustainability, Environment, Water, Population and Communities Online resource http://www.environment.gov.au/erin/ert/epbc/index.html , queried September 2012.

DSEWPaC (2012b) Species Profile and Threats Database (SPRAT) database. Department of Sustainability, Environment, Water, Population and Communities Online resource http://www.environment.gov.au/cgi-bin/sprat/public/sprat.p accessed September 2012.

Duffy, A.M., Lumsden, L.F., Caddle, C.R., Chick, R.R. and Newell, G.R. (2000). The efficacy of Anabat ultrasonic detectors and harp traps for surveying microchiropterans in southeastern Australia, *Acta Chiropterologica* 2: 127-144.

Hydro Tasmania Consulting (2008). Ben Chifley Dam to Bathurst Water Treatment Plant Pipeline Pre-feasibility Assessment. Report prepared for Bathurst Regional Council.

Mills, D.J., Norton, T.W., Parnaby, H.E., Cunningham, R.B. and Nix, H.A. (1996). Designing surveys for microchiropteran bats in complex forest landscapes – a pilot study from south-east Australia. *Forest Ecology and Management* 85(1-3):149-161.

OEH (2012a). NSW National Parks and Wildlife Service NSW Wildlife Atlas Database. Office of Environment and Heritage NSW. Data supplied by Office of Environment and Heritage, September 2012.

OEH (2012b) Threatened Species profiles website http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx Office of Environment and Heritage, accessed September 2012.

OEH (2012c). *National Recovery Plan for Booroolong Frog* (*Litoria booroolongensis*) Office of Environment and Heritage, Hurstville.

OEH (2012d) *Vegetation Types Database.* Office of Environment and Heritage. http://www.environment.nsw.gov.au/BioBanking/VegTypeDatabase.htm

OEH (2012e) *Vegetation Benchmarks Database*http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm

Pennay, M., Law, B., and Lunney, D. (2011). Review of the Distribution and status of the bat fauna of NSW and the ACT. Pp. 226-256 in The Biology and Conservation of Australian Bats, edited by Law., B Eby., P, Lunney., D, and Lumsden, L.

Pennay, M., Law, B., and Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats, NSW Department of Environment and Climate Change, Hurstville.

RBGT (2012). PlantNet - The Plant Information Network System of The Royal Botanic Gardens and Domain Trust, Sydney, Australia. Royal Botanic Gardens Trust, Sydney. http://plantnet.rbgsyd.nsw.gov.au/

Specht R.L. (1970). Vegetation. In: The Australian environment. (Ed. G.W. Leeper). pp. 44-67. CSIRO and Melbourne University Press, Melbourne.

Threatened Species Scientific Committee [TSSC] (2006). Advice to the Minister - White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands

Van Dyke, S. and Strahan, R. (2008). The Mammals of Australia (Third Edition). Reed New Holland.

Appendices

Appendix A Likelihood of occurrence of threatened biota

The following is an assessment of the likelihood of threatened and migratory species and threatened ecological communities existing in the Study Area. Assessments are based on the reliability (including age) of available records, the available habitat in the area, and whether the species was actually sighted during the surveys. A rank of Nil, Highly Unlikely, Possible, Likely and Present are allocated to each species for each potential route accordingly. Definitions of these terms are provided in Section 3.3. These rankings were used throughout the report to indicate potential impacts of the proposed works on threatened biota, and to guide mitigation recommendations.

Threatened ecological communities known or predicted from the locality, habitat association and likelihood of occurring in the study area

Scientific Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	EEC		Occurs on plateaus and tablelands between 600-900m asl with loam or clay soils derived primarily from basalt, but may also be derived from mudstones, granites, alluvium and other substrates. Known from Bathurst Regional, Goulburn Mulwaree, Oberon, Palerang, Shoalhaven, Upper Lachlan and Wingecarribee LGAs. Open, variable canopy which may include Ribbon Gum, Narrow-leaved Peppermint, Mountain Gum and Snow Gum, over a sparse shrub layer and dense groundcover of herbs and grass. Community also includes derived native grasslands where trees have been removed.	Recorded within 10km (OEH 2012)	Nil. Field surveys have confirmed that this TEC is not present.	Nil. Field surveys have confirmed that this TEC is not present.
White Box Yellow box Blakely's Red Gum Grassy Woodland and Derived Native Grassland (also known as Box-Gum Woodland)	EEC		White Box Yellow Box Blakely's Red Gum Woodland is an open woodland or forest community, and is characterized by White Box (Eucalyptus albens), Yellow Box (E. melliodora) and Blakely's Red Gum (E. blakelyi). Intact sites contain a high diversity of plant species, including dominant and additional tree species, shrubs, climbers, grass species and a high diversity of herbs. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified sites include the following areas where the main tree species are present ranging from an open woodland formation to a forest structure, with the groundlayer predominantly being composed of exotic species. On sites where the trees have been removed, only the grassy groundlayer and some herbs remain.	Recorded within 10km (OEH 2012)	Present. Three vegetation types in the study area are consistent with Box-gum woodland.	Present. Three vegetation types in the study area are consistent with Box-gum woodland.
White Box Yellow box Blakely's Red Gum Grassy Woodland and Derived Native Grassland		CEEC	As above, though the Commonwealth listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland differs slightly from the NSW listing. Areas that are part of the listed ecological community must have either an intact tree layer and predominately native ground layer or an intact native ground layer with a high diversity of native plant species but no remaining tree layer. Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. Field surveys have confirmed that this TEC is not present.	Nil. Field surveys have confirmed that this TEC is not present.

Threatened flora known or predicted from the locality, habitat association and likelihood of occurring in the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record*	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Derwentia blakelyi		V		This species of small shrub grows to 0.5 m and occurs in moist eucalypt forests in the western Blue Mountains of NSW. Restricted to the western Blue Mountains, near Clarence, near Mt Horrible, on Nullo Mountain and in the Coricudgy Range. Flowering occurs in summer.	1 record within 10km (OEH 2012)	Highly unlikely. The study area is west of the species known range and does not contain moist eucalypt forest habitat.	Highly unlikely. The study area is west of the species known range and does not contain moist eucalypt forest habitat.
Euphrasia scabra	Rough Eyebright	E		There are two extant populations in NSW: one in Bondi State Forest, one in South East Forests National Park. Occurs in or at the margins of swampy grassland or in sphagnum bogs, often in wet, peaty soil (OEH 2012).	1 record within 10km (OEH 2012) 2 records within 10km (Bathurst Regional Council records, 2012)	Likely. Potentially suitable habitat near the freshwater wetland at The Lagoon.	Likely. Potentially suitable habitat near the freshwater wetland at The Lagoon.
Euphrasia arguta			CE	Recently rediscovered near Nundle on the north-western slopes and tablelands, once known from scattered locations between Sydney, Bathurst and Walcha. Known populations occur in eucalypt forest with a mixed grass/shrub understorey, while previous records are described as occurring in open forest, grassy country and river meadows. Annual and dies back over winter. Dense stands observed in cleared firebreak areas, suggesting it may respond well to disturbance.	Predicted to occur within 10km (DSEWPaC 2012a) 1 record within 10km (Bathurst Regional Council records, 2012)	Possible. Potentially suitable habitat in woodland in the study area.	Possible. Potentially suitable habitat in woodland in the study area.
Eucalyptus pulverulenta	Silver-leafed Gum	V	V	The Silver-leafed Gum is a distinctively wattle-like, straggly mallee or small tree to about 10 m tall. This species grows in shallow soils as an understorey plant in open forest, typically dominated by Brittle Gum (*Eucalyptus mannifera*), Red Stringybark (*E. macrorhynca*), Broad-leafed Peppermint (*E. dives*), Silvertop Ash (*E. sieberi*) and Apple Box (*E. bridgesiana*). The Silver-leafed Gum is found in two quite separate areas, the Lithgow to Bathurst area and the Monaro (Bredbo, Bombala areas).	15 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 3 records within 10km (Bathurst Regional Council records, 2012)	Possible. Potentially suitable habitat in woodland in the study area.	Possible. Potentially suitable habitat in woodland in the study area.
Grevillea divaricata		E		Known only from the type collection made in 1823, north of Bathurst. Grows in dry open forest. Specimen notes describe the plant as occurring frequently in dry open forest lands and as possibly growing on rocky river margins (OEH 2012).	1 record within 10km (OEH 2012)	Possible. Potentially suitable habitat in woodland in the study area.	Possible. Potentially suitable habitat in woodland in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record*	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Lepidium hyssopifolium	Aromatic Peppercress	E	E	Currently known near Bathurst and Bungendore, with historic records near Armidale. Grows on light to heavy, often friable clay loams, often in highly modified environments amongst exotic pasture grasses and weeds. Requires bare ground to establish (Tumino 2010)	6 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 3 records within 10km (Bathurst Regional Council records, 2012)	Likely. Suitable habitat present in woodland and derived grasslands in the study area.	Likely. Suitable habitat present in woodland and derived grasslands in the study area.
Persoonia marginata	Clandulla Geebung	V	V	Known from only four disjunct locations on the Central Tablelands and Central Coast. Grows in dry sclerophyll forest and woodland communities on sandstone. Recorded flowering period varies and includes December and Winter (OEH 2012b).	1 record within 10km (OEH 2012) 1 record within 10km (Bathurst Regional Council records, 2012)	Highly unlikely. Outside of species'known range and no suitable dry sclerophyll forest on sandstone habitat in the study area.	Highly unlikely. Outside of species'known range and no suitable dry sclerophyll forest on sandstone habitat in the study area.
Swainsona sericea	Silky Swainson-pea	V		Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW.	3 records within 10km (OEH 2012) 3 records within 10km (Bathurst Regional Council records, 2012)	Possible. Potentially suitable habitat in woodland in the study area.	Possible. Potentially suitable habitat in woodland in the study area.
Thesium australe	Austral Toadflax	V	V	This species is a small straggling herb found in very small populations scattered across eastern NSW. It occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (*Themeda australis*).	Predicted to occur within 10km (DSEWPaC 2012a)	Possible. Potentially suitable habitat in woodland in the study area.	Possible. Potentially suitable habitat in woodland in the study area.
Zieria obcordata		E	E	Occurs at two sites with a geographic range of 105 km. These are Bulbudgeree Station near Wellington, and Crackerjack Rock/Rock Forests area NW of Bathurst. Grows in eucalypt woodland or shrubland dominated by species of Acacia on rocky hillsides. Also occurs in Eucalyptus and Callitris dominated woodland with an open, low shrub understorey, on moderately steep, west to north-facing slopes in sandy loam amongst granite boulders. The altitude range of sites is 500 to 830 metres.	1 record within 10km (OEH 2012)	Highly unlikely. Outside of species'known range and no suitable shruuby woodland on rocky hillside habitat in the study area.	Highly unlikely. Outside of species'known range and no suitable shruuby woodland on rocky hillside habitat in the study area.

All information in this table is taken from NSW OEH and Commonwealth DSEWPaC Threatened Species profiles (OEH 2012b, DSEWPaC 2011b) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population. Wildlife Atlas records: only records from 1980 or later were considered. The date of the last record is included for any species which have not been recorded within the last 20 years.

Threatened fauna known or predicted from the locality, habitat association and likelihood of occurring in the study area

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Birds							
Rostratula benghalensis	Australian Painted Snipe	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds. This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Predicted to occur within 10km (DSEWPaC 2012a)	Present. Recorded at the freshwater wetland at The Lagoon.	Present. Recorded at the freshwater wetland at The Lagoon.
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha* spp.and *Eleocharis* spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	2 records within 10km (Bathurst Regional Council records, 2012); recorded in 1977 and 2000	Possible. Potential habitat present at the freshwater wetland.	Possible. Potential habitat present at the freshwater wetland.
Ardeotis australis	Australian Bustard	E		Occurs in inland Australia; now scarce or absent from southern and south-eastern Australia (OEH 2012). In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Predominantly inhabits tussock and hummock grasslands, low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams.	1 record within 10km (Bathurst Regional Council records, 2012); recorded in the 1920s and 1950s.	Highly unlikely. Not recorded in the region for over 50 years.	Highly unlikely. Not recorded in the region for over 50 years.
Burhinus grallarius	Bush Stone-curlew	E	-	Scattered distribution across NSW. The nearest known population is bounded roughly by Albury, Wagga Wagga, Hay and Wentworth is regarded as the stronghold for the species in NSW (Barrett et al 2003, Atlas of NSW Wildlife), with small and scattered populations occurring throughout the central west of the state (Atlas of NSW Wildlife, Davey 2005). Inhabits lowland grassy woodland and open forest and, in coastal areas, Casuarina and Melaleuca woodlands, saltmarsh and mangroves. Requires a low, sparse groundcover, some fallen timber and leaf litter, and a general lack of a shrubby understory (DEC 2006).	1 record within 10km from the 1950s (Bathurst Regional Council records, 2012).	Highly unlikely. Not recorded in the region for over 50 years.	Highly unlikely. Not recorded in the region for over 50 years.
Ninox connivens	Barking Owl	V		Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and	1 record within 10km (OEH 2012)	Likely. Potential habitat present in larger woodland	Likely. Potential habitat present in larger woodland

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.		patches along the route alignment.	patches along the route alignment.
Melithreptus gularis gularis	Black-chinned Honeyeater	V		Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly smooth-barked gums, stringybarks and tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.	1 record within 10km (OEH 2012) 1 record within 10km (BirdLife Australia 2012) 2 records (Bathurst Regional Council records, 2012)	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Climacteris picumnus victoriae	Brown Treecreeper	V		This subspecies occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell through to the east coast of NSW, in relatively dry, open woodlands in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. More commonly observed on the inland slopes and plains west of the Great Dividing Range, it occurs in eucalypt woodlands and dry open forest, usually in woodlands dominated by stringybarks or other rough-barked species with an open grassy understorey. Fallen timber is an important habitat component for this predominately insectivorous species, which will forage in trees and on the ground. The species nests in hollows in standing trees or stumps.	1 record within 10km (OEH 2012) 19 records within 10km (BirdLife Australia 2012) 7 records (Bathurst Regional Council records, 2012)	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Stagonopleura guttata	Diamond Firetail	V		Typically found west of the Great Dividing Range, but populations also occur in drier coastal areas including W Sydney, Hunter, Clarence and Snowy River valleys. Occurs in grassy eucalypt woodlands including Box Gum and Snow Gum communities, as well as open forest, mallee and natural and derived grasslands. Often found in riparian areas and occasionally in lightly wooded farmland. Nests in shrubby understorey or higher up under nests of other species.	7 records within 10km (OEH 2012) 15 records within 10km (Birdlife Australia 2012) 16 records (Bathurst Regional Council records, 2012); recorded from 1909 to 2008	Present. Recorded near Chifley Dam and Bidgeribbin Road.	Present. Recorded near Chifley Dam and Bidgeribbin Road.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Petroica phoenicea	Flame Robin	V		This species is found from the Queensland border to Tasmania, western Victoria and south-east South Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	1 record within 10km (OEH 2012) 14 records within 10km (Birdlife Australia 2012) 10 records (Bathurst Regional Council records, 2012); recorded from 1894 to 2004	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Stictonetta naevosa	Freckled Duck	V		Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	1 record from 1992 (Bathurst Regional Council records, 2012) 10 recent records from Raglan Creek (Bathurst Regional Council records, 2013)	Possible. Could occur on occasion in the freshwater wetland during droughts.	Possible. Could occur on occasion in the freshwater wetland during droughts.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests.	7 records within 10km (OEH 2012) 9 records within 10km (Birdlife Australia 2012) 4 records (Bathurst Regional Council records, 2012)	Possible. May occur in woodland patches on occasion, although these are not considered preferred habitat.	Possible. May occur in woodland patches on occasion, although these are not considered preferred habitat.
Melanodryas cucullata cucullata	Hooded Robin	V		It is considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. The robin's occurrence is positively associated with patch size, and with components of habitat complexity that include the amount of tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Nests are sited on low, live or dead forks or branches of trees or stumps, or occasionally on fallen trees or limbs.	1 record within 10km (OEH 2012) 3 records (Bathurst Regional Council records, 2012); recorded from 1909 to 1998	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Hieraaetus morphnoides	Little Eagle	V		The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a	1 record within 10km (OEH 2012) 28 records within 10km	Present. Recorded near Chifley Dam. Likely to forage throughout woodland	Present. Recorded near Chifley Dam. Likely to forage throughout woodland

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment.	(Birdlife Australia 2012) 23 records (Bathurst Regional Council records, 2012); recorded from 1996 to 2008	patches, and may breed in woodland patches.	patches, and may breed in woodland patches.
Glossopsitta pusilla	Little Lorikeet	V		Distributed in dry, open eucalypt forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. They feed primarily on nectar and pollen of profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. meliodora* are particularly important food sources for pollen and nectar respectively. Nest hollows have small openings (approximately 3cm diameter) and are mostly found in living, smooth-barked eucalypts, especially Manna Gum *Eucalyptus viminalis*, Blakely's Red Gum *E. blakelyi* and Tumbledown Gum *E. dealbata*.	1 record within 10km (Birdlife Australia 2012) 1 record (Bathurst Regional Council records, 2012); recorded from 2008.	Likely. Potential habitat present in woodland patches along the route alignment.	Likely. Potential habitat present in woodland patches along the route alignment.
Leipoa ocellata	Malleefowl	E	V,M	Occurs in semi-arid to arid mallee country in the south-west of NSW. Its NSW stronghold is centred on Mallee Cliffs NP, extending east to Balranald and with scattered records north to Mungo NP. There are also populations in the Scotia mallee (W of the darling River), central NSW (chiefly Yathong, Nombinnie and Round Hill NR), and Dubbo (Goonoo forest). Occasional records exist from the Pilliga, around Cobar and Goulburn River NP. Inhabits predominately mallee communities, apparently preferring areas of sandy soil, abundant leaf litter, dense canopy and an abundance of food shrubs and herbs (especially legumes),	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. Outside natural range.	Nil. Outside natural range.
Limosa limosa	Black-tailed Godwit	V	M	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment	1 record from 1992 (Bathurst Regional Council records, 2012).	Possible. Outside usual range. Could occur at the freshwater wetland on rare occasions.	Possible. Outside usual range. Could occur at the freshwater wetland on rare occasions.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				works.			
Tyto novaehollandiae	Masked Owl	V		Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	1 record from the 1960s (Bathurst Regional Council records, 2012).	Highly unlikely. Not recorded in the locality for over 50 years.	Highly unlikely. Not recorded in the locality for over 50 years.
Anseranas semipalmata	Magpie Goose	V		Since the 1980s there have been an increasing number of records in central and northern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	2 records within 10km (OEH 2012) 1 record (Bathurst Regional Council records, 2012)	Possible. May occur at the freshwater wetland on a transitory basis.	Possible. May occur at the freshwater wetland on a transitory basis.
Anthochaera phrygia	Regent Honeyeater	CE	E	This species inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes. This species breeds in only three known key areas: the Capertee Valley and the Bundarra-Barraba region in NSW and Chiltern-Albury in Victoria. In NSW they are confined to the two main breeding areas and surrounding fragmented regions. Non-breeding flocks are sporadically seen in coastal areas, foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought or resource availability.	6 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 7 records (Bathurst Regional Council records, 2012); recorded from 1979 to 1997	Likely. Potential foraging habitat present in woodland patches.	Likely. Potential foraging habitat present in woodland patches.
Phaethon rubricauda	Red-tailed Tropicbird	V	M	Ranges throughout tropical and subtropical zones of the Indian and West Pacific Oceans, breeding on oceanic islands. Lord Howe Island is said to have the greatest breeding concentration in the world. Vagrant birds occur in coastal NSW waters, and occasionally even inland, particularly after storm events.(OEH 2012)	1 records within 10km (OEH 2012) 1 record from 1991 (Bathurst Regional Council records, 2012)	Highly unlikely. Outside natural range.	Highly unlikely. Outside natural range.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Petroica boodang	Scarlet Robin	V		In NSW this species occupies open forests and woodlands from the coast to the inland slopes. It breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees.	3 records within 10km (OEH 2012) 19 records within 10km (Birdlife Australia 2012) 7 records (Bathurst Regional Council records, 2012)	Likely. Potential foraging habitat present in woodland patches.	Likely. Potential foraging habitat present in woodland patches.
Pyrroholaemus sagittatus	Speckled Warbler	V		Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits a wide range of Eucalyptus-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of a low dense plant.	3 records within 10km (OEH 2012) 6 records within 10km (Birdlife Australia 2012) 13 records (Bathurst Regional Council records, 2012)	Likely. Potential foraging habitat present in larger woodland patches.	Likely. Potential foraging habitat present in larger woodland patches.
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Occurs on western slopes and plains , as well as in the Hunter Valley and several locations on the north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Family groups have territories between 1-50 (generally around 10) hectares. Nests typically built in shrubs or sapling eucalypts.	3 records (Bathurst Regional Council records, 2012); recorded from1899 to 1909.	Nil. Considered likely to be extinct in the Bathurst area.	Nil. Considered likely to be extinct in the Bathurst area.
Circus assimilis	Spotted Harrier	V		Occurs throughout Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Inhabits grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods). Most commonly in native grassland, but also in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	2 records within 10km (OEH 2012) 1 record within 10km (Birdlife Australia 2012)	Present. Recorded near Gormans Hill. Could forage throughout the study area. May breed in the study area.	Present. Recorded near Gormans Hill. Could forage throughout the study area. May breed in the study area.
Polytelis swainsonii	Superb Parrot	V	V	Occurs as a single population I the South-west Slopes and Riverina bioregions. Two core breeding areas: between Cowra and Yass – Grenfell, Cootamundra and Coolac in the SW Slopes, and along the Murray, Edward and Murrumbidgee Rivers in the Riverina. Birds breeding in the SW slopes migrate north to the Namoi/Gwydir Rivers for winter. Inhabits Box Gum, Box – Cypress Pine and Boree woodlands and River Red Gum Forest. Nest in hollow trees, in tall riparian River Red Gum	Predicted to occur within 10km (DSEWPaC 2012a	Unlikely. Could potentially forage and breed in woodland patches, but has not been recorded in the locality.	Unlikely. Could potentially forage and breed in woodland patches, but has not been recorded in the locality.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				communities (Riverina area) or open Box Gum woodland or isolated paddock trees (SW Slopes). Mainly forages in grassy box woodlands, up to 10km from breeding sites.			
Pandion haliaetus	Eastern Osprey	V	M	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea	1 record from 2009 (Bathurst Regional Council records, 2012)	Nil. Outside natural range.	Nil. Outside natural range.
Grantiella picta	Painted Honeyeater	V		Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	3 records (Bathurst Regional Council records, 2012) recorded from 1900-1901	Unlikely. Could potentially forage in woodlands in the study area but has not been recorded in the locality for many years.	Unlikely. Could potentially forage in woodlands in the study area but has not been recorded in the locality for many years.
Pedionomus torquatus	Plains-wanderer	E	V	Records over the past 30 years come from an area of the western Riverina bounded by Hay and Narrandera on the Murrumbidgee River in the north, the Cobb Highway in the west, the Billabong Creek in the south, and Urana in the east. (OEH2012). Occur in semi-arid, lowland high diversity native grasslands that typically occur on hard red-brown soils.	1 record (Bathurst Regional Council records, 2012); no date of record; observed on the outskirts of Bathurst (Kelso)	Nil. Outside known range.	Nil. Outside known range.
Lophoictinia isura	Square -tailed Kite	V		Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100m of ephemeral/permanent watercourse. Large home range > 100 km2.	1 record from the 1980s (Bathurst Regional Council records, 2012)	Possible. Could forage and breed in woodlands in the study area, however woodland habitat of low quality for this species.	Possible. Could forage and breed in woodlands in the study area, however woodland habitat of low quality for this species.
Lathamus discolor	Swift Parrot	E	E	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera,	Predicted to occur within 10km (DSEWPaC 2012a 2 record (Bathurst Regional Council records, 2012)	Possible. Could forage in woodland patches on occasion.	Possible. Could forage in woodland patches on occasion.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis and Swift Parrots will return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum E. globulus.			
Daphoenositta chrysoptera	Varied Sittella	V		The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	1 record within 10km (OEH 2012) 3 records within 10km (Birdlife Australia 2012) 5 records (Bathurst Regional Council records, 2012); recorded from 1899 to 2008	Likely. Could forage and breed in larger woodland patches in the study area.	Likely. Could forage and breed in larger woodland patches in the study area.
Mammals							
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. In NSW they occur along the whole Eastern section of the State.	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. No suitable habitat present.	Nil. No suitable habitat present.
Macrotis lagotis	Bilby	Extinct	V	Occurs in fragmented populations in mulga shrublands and spinifex grasslands in the Tanami Desert of the Northern Territory; in the Gibson and Great Sandy Deserts and the Pilbara and Kimberley regions of Western Australia; and the Mitchell Grasslands of southwest Queensland (OEH 2012). The Bilby prefers arid habitats because of the spinifex grass and acacia shrub.	2 records within 10km; no specific dates (Bathurst Regional Council records, 2012)	Nil. Extinct in NSW.	Nil. Extinct in NSW.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). In forested areas, it flies above the	1 record within 10km (OEH 2012)	Present. Recorded at a number of locations in the study area. Would forage in woodland patches and cleared areas in the study area. No breeding habitat	Present. Recorded at a number of locations in the study area. Would forage in woodland patches and cleared areas in the study area. No breeding habitat

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).		present.	present.
Vespadelus troughtoni	Eastern Cave Bat	V		Inhabits rainforest margins, wet and dry sclerophyll forests through to drier forests and woodlands in semi-arid environments. All records are within close proximity to sandstone or volcanic escarpments. Roosts in overhangs and caves, mines, boulder piles, abandoned Fairy Martin nests and occasionally in buildings, and regularly switches between alternate roost colonies. Forages over a small area, but are capable of flying 500 m over clear paddocks (Churchill 2008, Parnaby et al 2008).	No records in the locality.	Present. Probably recorded at the Macquarie River. May forage and breed in the study area. No breeding habitat present. May forage in the study area.	Present. Probably recorded at the Macquarie River. May forage and breed in the study area. No breeding habitat present. May forage in the study area.
Nyctophilus corbeni (= Nyctophilus timoriensis sp 2 *southeastern* form*)*	Greater Long-eared Bat	V	V	One of four forms of *Nyctophilus timoriensis* currently being described, this species is found throughout the Murray-Darling Basin and western slopes of the Great Dividing Range. Inhabit a variety of habitats including mallee, Bulloke, Box and Brigalow/Belah communities, but is more common in box/ironbark/cypress pine woodland on sandy soils, with distinct canopy and dense understorey. Roost in fissures or under bark, with tree hollows used as maternity sites. May forage at least 3 km from the roost (Churchill 2008, Turbill et al 2008).	1 record, no specific dates (Bathurst Regional Council records, 2012)	Possible. Could forage and breed in woodland patches in the study area.	Possible. Could forage and breed in woodland patches in the study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	This species roosts in camps generally located within 20 km of a regular food source and are commonly found in gullies, close to water and in vegetation with a dense canopy. This species is known to forage in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias. Grey-headed Flying-fox show a regular pattern of seasonal movement with much of the population moving to northern NSW and QLD during May and June to exploit winter flowering tree species (Eby and Law 2008). This species will also forage in urban gardens and cultivated fruit crops.	3 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 8 records (Bathurst Regional Council records, 2012)	Present. Could forage in woodland patches throughout the study area on occasion. No breeding habitat present.	Present. Could forage in woodland patches throughout the study area on occasion. No breeding habitat present.
Phascolarctos cinereus	Koala	V	V	The Koala is protected under SEPP 44, which aims to conserve habitat within its current distribution. The Koala has a fragmented distribution throughout eastern Australia. It is limited to areas of preferred feed trees in eucalypt woodlands and forests. Along the coastal fringe these areas are becoming more fragmented and isolated due to urbanisation. Koalas are generally inactive for 20 hours a day, with activity peaking just after sunset when	794 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 13 records (Bathurst Regional Council records, 2012); recorded from	Likely. Likely to forage in larger woodland patches. Main area of habitat lies about 1.5 km to the south-west of The Freshwater wetland.	Likely. Likely to forage in larger woodland patches. Main area of habitat lies about 1.5 km to the south-west of The Freshwater wetland.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				they begin to forage (Martin and Handasyde 1995). The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size. Females breed at two years of age and produce one young per year.	1975 to 2009		
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 2008).	1 record within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a)	Possible. May forage on occasion in the study area.	Possible. May forage on occasion in the study area.
Myotis macropus	Large-footed Myotis	V		Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Churchill 2008)	No records in the locality.	Present. Probably recorded at the Macquarie River. May forage and breed in the study area.	Present. Probably recorded at the Macquarie River. May forage and breed in the study area.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	7 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 4 records (Bathurst Regional Council records, 2012); recorded from 1986 to 2008	Likely. May occur in woodland patches in the study area.	Likely. May occur in woodland patches in the study area.
Petaurus australis	Yellow-bellied Glider	V		Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.	1 record, no specific dates (Bathurst Regional Council records, 2012)	Unlikely. No suitable mature forest present in the study area.	Unlikely. No suitable mature forest present in the study area.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Migrates from tropics to SE Australia in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings. Also known to use animal burrows in treeless areas (Churchill 2008).	No records in the locality.	Present. Probably recorded at the freshwater lagoon and Campbells River. May forage and breed in the study area.	Present. Probably recorded at the freshwater lagoon and Campbells River. May forage and breed in the study area.
Reptiles							
Hoplocephalus bungaroides	Broad-Headed Snake	E	V	The Broad-headed snake is nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. It feeds mostly on geckos and small skinks, as well as occasionally on frogs and small mammals.	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. No suitable escarpment habitat present.	Nil. No suitable escarpment habitat present.
Aprasia pulchella	Pink-tailed Worm-lizard	V	V	Populations occur in the Queanbeyan/Canberra district, Cooma, Yass, Bathurst, Albury and West Wyalong areas. Inhabits grassland and open woodland with substantial embedded rock cover in sunny situations. Recorded in both native and non-native grasslands. Usually recorded under small rocks (150 - 600 mm basal area) shallowly embedded in the soil (2 - 5 cm), and use ant burrows under these rocks.	No records within 10 km. Not predicted to occur within 10 km by DSEWPaC (2012a) Listed in pre-feasability assessment as occurring in the region.	Unlikely. No suitable areas of lightly embedded rocks present in the study area. Very little native grassland present.	Unlikely. No suitable areas of lightly embedded rocks present in the study area. Very little native grassland present.
Suta flagellum	Little Whip Snake	V		Occurs between Crookwell, Bombala, Braidwood and Tumbarumba. Inhabits natural temperate grasslands and grassy woodlands, often dominated by Eucalyptus pauciflora or E. melliodora, as well as secondary grasslands derived from cleared woodlands. Found on well drained hillsides, mostly associated with scattered loose rocks. Often found under logs and rocks on or partially embedded into the ground. Primarily eat frogs and small lizards.	1 record from 1985 (Bathurst Regional Council records, 2012)	Unlikely. Very little native grassland present. No suitable areas of lightly embedded rocks present in the study area.	Unlikely. Very little native grassland present. No suitable areas of lightly embedded rocks present in the study area.
Tympanocryptis pinguicolla	Grassland Earless Dragon/South-eastern Lined Dragon	E	E	Occurs in a restricted number of Natural Temperate Grassland sites dominated by Nothodanthonia spp., Austrostipa spp., Poa sieberiana, Bothriochloa macra, and occasionally Themeda australis. Prefer areas with a more open structure, with areas of bare ground present. Partially embedded surface rocks, and spider and insect holes are also utilised for sheltering and are an essential requirement for this species to persist in an area.	8 records (Bathurst Regional Council records, 2012); recorded between 1940s and 1993	Unlikely. Very little native grassland present. No suitable areas of lightly embedded rocks present in the study area.	Unlikely. Very little native grassland present. No suitable areas of lightly embedded rocks present in the study area.
Frogs							

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Litoria booroolongensis	Booroolong Frog	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from the Northern Tablelands and is now rare throughout most of the remainder of its range. Most recent records are from the south-west slopes of NSW. The frog lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins, and will shelter under rocks or amongst vegetation near the ground on the stream edge occasionally basking in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools.	9 records within 10km (OEH 2012) Predicted to occur within 10km (DSEWPaC 2012a) 4 records (Bathurst Regional Council records, 2012); recorded from 1966 to 2000	Likely. Potential habitat present near Chifley Dam.	Present. Recorded at Macquarie River. Potential habitat present near Chifley Dam.
Litoria aurea	Green and Golden Bell Frog	E	V	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. Gambusia holbrooki is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles. The type locality for the species is the Macquarie River in Bathurst. The last positive record of the species was in 1973, however there are more recent records that need to be investigated (DEC 2005).	7 records within 10km (OEH 2012) 5 records (Bathurst Regional Council records, 2012)	Possible. May occur in farm dams near the alignment. Could forage and disperse in woodland patches.	Possible. May occur in farm dams near the alignment. Could forage and disperse in woodland patches.
Litoria raniformis	Southern Bell Frog	E	V	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat.	7 records from 1965 (Bathurst Regional Council records, 2012)	Unlikely. While limited potential habitat is present in the freshwater wetland, the species has not been recorded in the region for many years.	Unlikely. While limited potential habitat is present in the freshwater wetland, the species has not been recorded in the region for many years.
Invertebrates							
Paralucia spinifera	Bathurst Copper Butterfly	E	V	Occurs on the Central Tablelands of NSW in an area approximately bounded by Oberon, Hartley and Bathurst, above 850 m asl. The butterfly is found at 35	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. Study area well below the altitude at which the species is	Nil. Study area well below the altitude at which the species is

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				locations, all with a west to north-west aspect, usually where direct sunlight reaches the habitat, and with extremes of cold such as regular winter snowfalls or heavy frosts. Geology, soils and dominant vegetation canopy species vary between habitat locations. However vegetation structure is consistent, commonly open woodland or open forest with a sparse understorey that is dominated by the shrub, Blackthorn Bursaria spinosa subsp. lasiophylla. Its lifecycle relies on a mutualistic relationship with the ant, Anonychomyra itinerans, and on the presence of B. spinosa subsp. lasiophylla which is used as the larval food plant. The butterflies emerge between August (later at higher altitude sites) and November, with a two-week peak of activity in September.		known to occur.	known to occur.

All information in this table is taken from NSW OEH Threatened Species profiles (DEC 2005) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; M – Migratory. Wildlife Atlas records: only records from 1980 or later were considered. The date of the last record is included for any species which have not been recorded within the last 20 years.

EPBC Act-listed migratory fauna known or predicted from the locality, habitat association and suitable habitat present at the subject site

Scientific Name	Common Name	TSC Status	EPBC Status	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Wetland or Marine species							
Rostratula benghalensis	Australian Painted Snipe	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds. This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Predicted to occur within 10km (DSEWPaC 2012a)	Recorded at the freshwater wetland.	Recorded at the freshwater wetland.
Calidris ferruginea	Curlew Sandpiper	E		The Curlew Sandpiper is distributed around most of the coastline of Australia (including Tasmania) (Higgins & Davies 1996; Geering et al. 2007). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts.	4 records within 10km (Birdlife Australia 2012)	Possible. Outside usual range. Could occur at the freshwater wetland on rare occasions.	Possible. Outside usual range. Could occur at the freshwater wetland on rare occasions.
Apus pacificus	Fork-tailed Swift		M; Marine	Recorded in all regions of NSW. Non- breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	Predicted to occur within 10km (DSEWPaC 2012a)	Likely. May forage high above the study area on occasion.	Likely. May forage high above the study area on occasion.
Ardea alba	Great Egret		M; Marine	Occurs across NSW. Within NSW there are breeding colonies within the Darling Riverine Plains and Riverina regions, and minor colonies across its range including the north and north-east of the state. Reported from a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	Predicted to occur within 10km (DSEWPaC 2012a)	Likely. Likely to occur along the river and at the freshwater wetland.	Likely. Likely to occur along the rivers and at the freshwater wetland.
Ardea ibis	Cattle Egret		M; Marine	Occurs across NSW. Principal breeding sites are the central east coast from Newcastle to Bundaberg. Also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Uses predominately shallow, open and fresh wetlands with low emergent vegetation and abundant aquatic flora. Sometimes observed in swamps with tall emergent vegetation and commonly use areas of tall pasture	Predicted to occur within 10km (DSEWPaC 2012a)	Likely. Likely to occur at the freshwater wetland and in paddocks with cattle.	Likely. Likely to occur at the freshwater wetland and in paddocks with cattle.

Scientific Name	Common Name	TSC Status	EPBC Status	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
				in moist, low-lying areas.			
Gallinago hardwickii	Latham's Snipe		M; Marine	Occurs along the coast and west of the great dividing range. Non breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.	Predicted to occur within 10km (DSEWPaC 2012a)	Recorded at the freshwater wetland.	Recorded at the freshwater wetland.
Terrestrial species							
Haliaeetus leucogaster	White-bellied Sea-eagle		M, Marine	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	Predicted to occur within 10km (DSEWPaC 2012a)	LIkely. Has been sighted at The Laggon. May occur on occasion.	LIkely. Has been sighted at The Laggon. May occur on occasion.
Hirundapus caudacutus	White-throated Needletail		M; Marine	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	Predicted to occur within 10km (DSEWPaC 2012a)	Likely. May forage high above the study area on occasion.	Likely. May forage high above the study area on occasion.
Merops ornatus	Rainbow Bee-eater		M; Marine	Widespread across mainland Australia. Mainly inhabits open forests and woodlands and shrublands, often in proximity to permanent water. Also occurs in cleared/semi-cleared habitats including farmland and residential areas. Excavates a nest burrow in flat/sloping ground in banks of waterways, dams, roadside cuttings, gravel pits or cliff faces. Southern populations migrate north for winter after breeding.	Predicted to occur within 10km (DSEWPaC 2012a)	Recorded. Recorded at a number of locations in the study area.	Recorded. Recorded at a number of locations in the study area.
Monarcha melanopsis	Black-faced Monarch		M; Marine	Summer breeding migrant to south-east. Occurs along the coast of NSW. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (Birds Australia 2005).	Predicted to occur within 10km (DSEWPaC 2012a)	Nil. Outside natural range.	Nil. Outside natural range.

Scientific Name	Common Name	TSC Status	EPBC Status	Habitat Association	Nature of Record	Likelihood of occurrence Route 1	Likelihood of occurrence Route 2
Myiagra cyanoleuca	Satin Flycatcher		M; Marine	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. May occur on occasion in the region, however preferred habitat is not present.	Unlikely. May occur on occasion in the region, however preferred habitat is not present.
Calidris acuminata	Sharp-tailed Sandpiper		M; Marine	They are widespread in most regions of New South Wales (NSW) and Victoria, especially in coastal areas, but they are sparse in the south-central Western Plain and east Lower Western Regions of NSW, and north-east and north-central Victoria (Higgins & Davies 1996).	Records within 10km (Birdlife Australia 2012)	Likely. Has been observed at the freshwater wetland on occasions.	Likely. Has been observed at the freshwater wetland on occasions.
Rhipidura rufifrons	Rufous Fantail		M; Marine	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	Records within 10km (Birdlife Australia 2012)	Unlikely. Rare visitor to the Central West CMA.	Unlikely. Rare visitor to the Central West CMA.
Anthochaera phrygia	Regent Honeyeater	CE	E, M	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	6 records within 10km (OEH 2012) 7 records (Bathurst Regional Council records, 2012)	Likely. Potential foraging habitat present in woodland patches.	Likely. Potential foraging habitat present in woodland patches.

All information in this table is taken from NSW OEH and Commonwealth DSEWPaC Threatened Species profiles (DEC 2005, DSEWPaC 2011b) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community; M - Migratory.

Appendix B – Species Lists

The following is a complete list of all the species recorded within the Study Area during surveys. The following codes are used in these tables:

- Conservation status of species is identified with respect to their listing under the TSC Act or the EPBC Act where relevant (E – endangered; M – migratory; V – vulnerable).
- Exotic species are denoted with an asterisk (*).
- Flora species are marked with a number to indicate their cover abundance within a quadrat (1 – less than 5% or rare; 2 – less than 5% or common; 3 – 6-15%; 4 – 16-25%; 6 - 51-75%; 7 – 76-100%), or with an X to denote a species not found within the quadrat but characteristic of the vegetation in the vicinity of the quadrat.
- Fauna species are marked with the OEH Atlas of NSW Wildlife observation codes (B – burrow; F – tracks and scratchings; H – skin; K – dead; O – observed; P – scat; W – heard).

This data aligns with Figures 2 and 4 within the body of the main report.

Flora species list

Family	Exotic	Scientific Name	Common Name	TSC Act	EPBC Act	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Adiantaceae		*Cheilanthes* spp.	Cloak Fern			2										
Amygdalaceae	*	*Prunus* spp.				×										
Apiaceae	*	*Ammi majus*	Bishop's Weed								3			3		
Apiaceae		*Hydrocotyle laxiflora*	Stinking Pennywort									2				1
Asparagaceae	*	*Asparagus officinalis*	Asparagus			×										
Asteraceae		*Calotis cuneifolia*	Purple Burr-Daisy			2										
Asteraceae		*Cassinia uncata*	Sticky Cassinia			×										
Asteraceae		*Chrysocephalum apiculatum*	Common Everlasting					1								
Asteraceae	*	*Cirsium vulgare*	Spear Thistle			×		1	1				2	2	1	2
Asteraceae	*	*Conyza bonariensis*	Flaxleaf Fleabane				2					2	2		1	2
Asteraceae		*Gnaphalium* spp.	Cudweed												1	2
Asteraceae	*	*Hypochaeris radicata*	Catsear					2								
Asteraceae	*	*Lactuca serriola*	Prickly Lettuce			×										
Asteraceae	*	*Onopordum acanthium* subsp. *acanthium*	Scotch Thistle							2						
Asteraceae	*	*Silybum marianum*	Variegated Thistle								3	2		2		×
Asteraceae	*	*Soliva sessilis*	Bindyi												1	
Asteraceae	*	*Sonchus asper* subsp. *glaucescens*	Prickly Sowthistle						2	1						1
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle			1										
Asteraceae	*	*Taraxacum officinale*	Dandelion			2									2	
Asteraceae	*	*Tragopogon porrifolius* subsp. *porrifolius*	Salsify			×				2						
Azollaceae		*Azolla* spp.							2							
Boraginaceae	*	*Echium plantagineum*	Patterson's Curse			×	2	2	1		2	2	2		1	2
Brassicaceae	*	*Brassica tournefortii*	Mediterranean Turnip			2	2				2	2	1	2		

Family	Exotic	Scientific Name	Common Name	TSC Act	EPBC Act	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Brassicaceae	*	*Capsella bursa-pastoris*	Shepherd's Purse				2	2							2	
Brassicaceae	*	*Lepidium virginicum*	Virginian Peppercess				2									
Brassicaceae	*	*Sisymbrium orientale*	Indian Hedge Mustard				1									
Brassicaceae	*	*Turritis glabra*	Tower Mustard							2		2				2
Cactaceae	*	*Opuntia stricta*	Common Prickly Pear			1		2								
Campanulaceae		*Wahlenbergia communis*	Tufted Bluebell			1		2								2
Caryophyllaceae	*	*Petrorhagia nanteuilii*	Proliferous Pink			×										
Casuarinaceae		*Casuarina cunninghamiana* subsp. *cunninghamiana*	River Oak													
Chenopodiaceae	*	*Chenopodium album*	Fat Hen												1	
Chenopodiaceae		*Einadia nutans*	Climbing Saltbush									2				
Chenopodiaceae		*Einadia polygonoides*	Knotweed Goosefoot			×										
Clusiaceae	*	*Hypericum perforatum*	St. Johns Wort			×				2			2			
Convolvulaceae		*Convolvulus erubescens*	Pink Bindweed													2
Cyperaceae		*Carex appressa*	Tall Sedge						2							
Cyperaceae	*	*Cyperus eragrostis*	Umbrella Sedge			×			2							
Fabaceae (Faboideae)		*Glycine tabacina*	Variable Glycine			2										1
Fabaceae (Faboideae)	*	*Medicago arabica*	Spotted Burr Medic										2			
Fabaceae (Faboideae)	*	*Medicago minima*	Woolly Burr Medic							2		1				
Fabaceae (Faboideae)	*	*Medicago polymorpha*	Burr Medic											2		2
Fabaceae (Faboideae)	*	*Trifolium angustifolium*	Narrow-leaved Clover			2				2						
Fabaceae (Faboideae)	*	*Trifolium arvense*	Haresfoot Clover			×	2			2		2	2			
Fabaceae (Faboideae)	*	*Trifolium subterraneum*	Subterranean Clover										2		2	
Fabaceae (Faboideae)	*	*Vicia sativa*	Common vetch			×							1	2		
Fabaceae (Mimosoideae)		*Acacia dealbata*	Silver Wattle											×		
Fabaceae (Mimosoideae)		*Acacia deanei*	Green Wattle			×										
Geraniaceae		*Geranium solanderi* var. *solanderi*				2		2	1			2	2			2

Family	Exotic	Scientific Name	Common Name	TSC Act	EPBC Act	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Juncaceae		*Juncus usitatus*				1			3							
Lamiaceae	*	*Marrubium vulgare*	White Horehound				2					2				
Lomandraceae		*Lomandra filiformis* subsp. *filiformis*					2									
Lomandraceae		*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush			2		2				1	1			1
Malaceae	*	*Crataegus monogyna*	Hawthorn										3			
Malaceae	*	*Pyracantha angustifolia*	Orange Firethorn										3			
Malvaceae	*	*Modiola caroliniana*	Red-flowered Mallow													2
Malvaceae		*Sida corrugata*	Corrugated Sida													1
Malvaceae		*Sida cunninghamii*	Ridge Sida										1			
Myrsinaceae	*	*Anagallis arvensis*	Scarlet Pimpernel			×										
Myrtaceae		*Eucalyptus blakelyi*	Blakely's Red Gum			×	×	3					3			
Myrtaceae		*Eucalyptus bridgesiana*	Apple Box			3	3					3				3
Myrtaceae		*Eucalyptus melliodora*	Yellow Box			3	3	3								3
Myrtaceae		*Eucalyptus viminalis*	Ribbon Gum											×		×
Oxalidaceae		*Oxalis perennans*														1
Oxalidaceae		*Oxalis spp.*					1					1				
Phormiaceae		*Dianella revoluta*	Blueberry Lily			2										
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues			2	2	1								1
Plantaginaceae	*	*Veronica catenata*	Pink Water-speedwell											1		
Poaceae		*Austrodanthonia eriantha*	Wallaby Grass			2		2								
Poaceae		*Austrodanthonia monticola*	A Wallaby Grass					2								
Poaceae		*Austrodanthonia* spp.	A Wallaby Grass			2										
Poaceae		*Austrostipa scabra*	Speargrass			2	3	4		2		2				1
Poaceae	*	*Avena fatua*	Wild Oats			3	3	2								
Poaceae	*	*Briza maxima*	Quaking Grass			1										
Poaceae	*	*Briza minor*	Shivery Grass												2	

Family	Exotic	Scientific Name	Common Name	TSC Act	EPBC Act	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Poaceae	*	*Bromus diandrus*	Great Brome			2	4		2	4	4	3	4	4		4
Poaceae	*	*Bromus molliformis*	Soft Brome													2
Poaceae		*Cynodon dactylon*	Common Couch			2	2		1					3		
Poaceae	*	*Dactylis glomerata*	Cocksfoot			3	2	2			3		2	2		
Poaceae	*	*Eragrostis spp.*	A Lovegrass			×				2						
Poaceae	*	*Holcus lanatus*	Yorkshire Fog											2	2	
Poaceae	*	*Hordeum leporinum*	Barley Grass			×		2	3					2	3	
Poaceae	*	*Lolium perenne*	Perennial Ryegrass			2										
Poaceae	*	*Lolium rigidum*	Wimmera Ryegrass				2	2	3		2		2	2	5	3
Poaceae	*	*Nassella neesiana*	Chilean Needle Grass			×	3	2			2	2				2
Poaceae	*	*Phalaris aquatica*	Phalaris			2					2			2		
Poaceae		*Phragmites australis*	Common Reed								x			×		
Poaceae		*Poa sieberiana* var. *sieberiana*	Snowgrass			2					3			2		2
Poaceae		*Themeda australis*	Kangaroo Grass			2										
Poaceae		*Triticum* spp.				2										
Poaceae		*Zoysia macrantha*	Prickly Couch						3							
Polygonaceae	*	*Acetosella vulgaris*	Sheep Sorrel			×		1		2		2	2		1	
Polygonaceae		*Persicaria lapathifolia*	Pale Knotweed											2		
Polygonaceae	*	*Polygonum aviculare*	Wireweed			×										
Polygonaceae		*Rumex brownii*	Swamp Dock													2
Polygonaceae	*	*Rumex crispus*	Curled Dock				×		2		2			2		
Polygonaceae	*	*Rumex spp.*	Dock			×	×					1		2		
Ranunculaceae	*	*Ranunculus sceleratus*	Celery Buttercup						3							
Rosaceae		*Acaena novae-zelandiae*	Bidgee-widgee			2		2								
Rosaceae		*Acaena ovina*	Acaena									2	2			2
Rosaceae	*	*Rosa rubiginosa*	Sweet Briar			×										

Family	Exotic	Scientific Name	Common Name	TSC Act	EPBC Act	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Rosaceae	*	*Rubus fruticosus* sp. agg.	Blackberry complex								4	3	3	2		1
Rubiaceae	*	*Galium aparine*	Goosegrass			×							2			
Rubiaceae		*Galium* sp.														1
Salicaceae		*Salix* sp.	Willow								4					x
Scrophulariaceae		*Orobanche cernua* var. *australiana*	Australian Broomrape			1										
Scrophulariaceae	*	*Verbascum thapsus* subsp. *thapsus*	Great Mullein				×									
Scrophulariaceae	*	*Verbascum virgatum*	Twiggy Mullein							2						
Solanaceae	*	*Lycium ferocissimum*	African Boxthorn			×	2				3	3				
Solanaceae	*	*Solanum nigrum*	Black-berry Nightshade													1
Typhaceae		*Typha orientalis*	Broad-leaved Cumbungi						×		x					
Verbenaceae	*	*Verbena bonariensis*	Purpletop											1		

Fauna species list

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BIRDS																				
Acanthizidae		*Acanthiza lineata*	Striated Thornbill										O							
Acanthizidae		*Smicrornis brevirostris*	Weebill						O			W	O							
Acanthizidae		*Gerygone fusca*	Western Gerygone						W											
Acanthizidae		*Sericornis frontalis*	White-browed Scrubwren									O	O			O			O	
Acanthizidae		*Acanthiza nana*	Yellow Thornbill															O		
Acanthizidae		*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill			O	O		O		W	W		O		W		O		
Accipitridae		*Elanus axillaris*	Black-shouldered Kite							O										
Accipitridae		*Hieraaetus morphnoides*	Little Eagle	V								O								
Accipitridae		*Circus assimilis*	Spotted Harrier	V		O														
Acrocephalidae		*Acrocephalus australis*	Australian Reed-Warbler																	W
Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra					W								O				
Alcedinidae		*Todiramphus sanctus*	Sacred Kingfisher									W				O				
Anatidae		*Chenonetta jubata*	Australian Wood Duck						W			O								
Anatidae		*Anas gracilis*	Grey Teal							O		O		O				O		
Anatidae		*Aythya australis*	Hardhead							O										
Anatidae		*Anas superciliosa*	Pacific Black Duck				O			O	W	O		O						O
Anatidae		*Malacorhynchus membranaceus*	Pink-eared Duck							O										
Anhingidae		*Anhinga novaehollandiae*	Australasian Darter													O				
Ardeidae		*Egretta novaehollandiae*	White-faced Heron											O						
Ardeidae		*Ardea pacifica*	White-necked Heron							O										
Artamidae		*Cracticus tibicen*	Australian Magpie			O	O	O	O	O	O		O		O	O	O			O
Artamidae		*Artamus cyanopterus*	Dusky Woodswallow			O			O				O			O		O	O	
Artamidae		*Cracticus torquatus*	Grey Butcherbird					O	O								W			

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Artamidae		*Artamus minor*	Little Woodswallow										O							
Artamidae		*Cracticus nigrogularis*	Pied Butcherbird						W											
Artamidae		*Strepera graculina*	Pied Currawong						W		W									
Cacatuidae		*Eolophus roseicapillus*	Galah			O		O		O		O	O		O	O	O			
Cacatuidae		*Cacatua sanguinea*	Little Corella									O								
Cacatuidae		*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo																	O
Campephagidae		*Coracina novaehollandiae*	Black-faced Cuckoo-shrike					O	O				O				W	O		
Campephagidae		*Lalage sueurii*	White-winged Triller										O							
Charadriidae		*Elseyornis melanops*	Black-fronted Dotterel							O										
Charadriidae		*Vanellus miles*	Masked Lapwing							O			O							O
Cisticolidae		*Cisticola exilis*	Golden-headed Cisticola							O	W									
Climacteridae		*Cormobates leucophaea*	White-throated Treecreeper									W						W		
Columbidae		*Phaps chalcoptera*	Common Bronzewing						W											
Columbidae		*Ocyphaps lophotes*	Crested Pigeon					O			O	O	O		O		W			
Columbidae		*Geopelia striata*	Peaceful Dove						W									W		
Coraciidae		*Eurystomus orientalis*	Dollarbird						W						O	O	W			
Corcoracidae		*Corcorax melanorhamphos*	White-winged Chough					O	O								W			
Corvidae		*Corvus coronoides*	Australian Raven						W								W	W		
Corvidae		*Corvus mellori*	Little Raven						W											
Corvidae		*Corvus orru*	Torresian Crow					W	W		W	W			O					
Cuculidae		*Cacomantis flabelliformis*	Fan-tailed Cuckoo						W									W		
Cuculidae		*Chalcites basalis*	Horsfield's Bronze-cuckoo										W							
Cuculidae		*Cacomantis pallidus*	Pallid Cuckoo									O					W			
Cuculidae		*Chalcites lucidus*	Shining Bronze-cuckoo										W							

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Estrildidae		*Stagonopleura guttata*	Diamond Firetail	V									O			W				
Estrildidae		*Taeniopygia bichenovii*	Double-barred Finch										O							
Estrildidae		*Neochmia temporalis*	Red-browed Finch											O		O		O	O	W
Falconidae		*Falco berigora*	Brown Falcon							O									O	
Falconidae		*Falco cenchroides*	Nankeen Kestrel						O		W									
Fringillidae	*	*Carduelis carduelis*	European Goldfinch							O										
Hirundinidae		*Hirundo neoxena*	Welcome Swallow							O			O			O		O	O	
Maluridae		*Malurus cyaneus*	Superb Fairy-wren			O	O			O	W	O		O		O		O		O
Megaluridae		*Megalurus gramineus*	Little Grassbird							W										
Megaluridae		*Cincloramphus mathewsi*	Rufous Songlark							O										
Meliphagidae		*Melithreptus brevirostris*	Brown-headed Honeyeater										O							
Meliphagidae		*Philemon corniculatus*	Noisy Friarbird						O		W		O			W	W	W		
Meliphagidae		*Manorina melanocephala*	Noisy Miner					O	O					O	O		O			
Meliphagidae		*Anthochaera carunculata*	Red Wattlebird						W			W	W							
Meliphagidae		*Lichenostomus penicillatus*	White-plumed Honeyeater										O			O		O	O	
Meliphagidae		*Lichenostomus chrysops*	Yellow-faced Honeyeater										O			W			O	W
Meropidae		*Merops ornatus*	Rainbow Bee-eater		M							W				W				
Monarchidae		*Grallina cyanoleuca*	Magpie-lark					W		O	W	O	O			O	W			W
Monarchidae		*Myiagra inquieta*	Restless Flycatcher						W											
Motacillidae		*Anthus novaeseelandiae*	Australian Pipit							O										
Nectariniidae		*Dicaeum hirundinaceum*	Mistletoebird						W											
Oriolidae		*Oriolus sagittatus*	Olive-backed Oriole										W							
Pachycephalidae		*Pachycephala pectoralis*	Golden Whistler						W											
Pachycephalidae		*Pachycephala pectoralis*	Golden Whistler														W			
Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush					W								W		W		

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pachycephalidae		*Pachycephala rufiventris*	Rufous Whistler						W			W	O			W	W	O	W	
Pardalotidae		*Pardalotus punctatus*	Spotted Pardalote									W				W				
Pardalotidae		*Pardalotus striatus*	Striated Pardalote					W			W				W		W			
Passeridae	*	*Passer domesticus*	House Sparrow			O														
Pelecanidae		*Pelecanus conspicillatus*	Australian Pelican							O										
Petroicidae		*Microeca fascinans*	Jacky Winter			O			W									O		
Phalacrocoracidae		*Phalacrocorax carbo*	Great Cormorant							O										
Phasianidae		*Coturnix ypsilophora*	Brown Quail															O		
Podargidae		*Podargus strigoides*	Tawny Frogmouth						W								O			
Podicipedidae		*Tachybaptus novaehollandiae*	Australasian Grebe				O			O										
Psittacidae		*Platycercus elegans*	Crimson Rosella				O	O	O				O			O	W	O	O	
Psittacidae		*Platycercus eximius*	Eastern Rosella						O		O		O		O	O	O			
Psittacidae		*Psephotus haematonotus*	Red-rumped Parrot						O		O		O				W	O	O	
Rallidae		*Gallinula tenebrosa*	Dusky Moorhen							O				O		W	W	O		
Rallidae		*Fulica atra*	Eurasian Coot							O										W
Rallidae		*Porphyrio porphyrio*	Purple Swamphen							O										
Rallidae		*Porzana tabuensis*	Spotless Crake							O										
Recurvirostridae		*Himantopus himantopus*	Black-winged Stilt							O										
Rhipiduridae		*Rhipidura albiscapa*	Grey Fantail					O	O			O		O	W	O	W	O	O	W
Rhipiduridae		*Rhipidura leucophrys*	Willie Wagtail						O			O		O			W	O	O	
Rostratulidae		*Rostratula australis*	Australian Painted Snipe	E1	M					O										
Scolopacidae		*Gallinago hardwickii*	Latham's Snipe		M					O										
Scolopacidae		*Calidris ruficollis*	Red-necked Stint							O										
Sturnidae	*	*Sturnus tristis*	Common Myna																	
Sturnidae	*	*Sturnus vulgaris*	Common Starling						O	O	W									O

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Threskiornithidae		*Threskiornis molucca*	Australian White Ibis							O										
Timaliidae		*Zosterops lateralis*	Silvereye								W		O				W			
Turdidae	*	*Turdus merula*	Eurasian Blackbird								W		W				W		O	
MAMMALS																				
Canidae	*	*Vulpes vulpes*	Fox				P		P									O	P	
Leporidae	*	*Lepus capensis*	Brown Hare					O					O							
Leporidae	*	*Oryctolagus cuniculus*	Rabbit										O			O	O		O	O
Macropodidae		*Macropus giganteus*	Eastern Grey Kangaroo						O						O			P		
Macropodidae		*Wallabia bicolor*	Swamp Wallaby															O		
Molossidae		*Tadarida australis*	White-striped Freetail-Bat						W				W				W			W
Petauridae		*Petaurus breviceps*	Sugar Glider						O			F	F			F				
Pteropodidae		*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	O														
Tachyglossidae		*Tachyglossus aculeatus*	Short-beaked Echidna						F											
Vombatidae		*Vombatus ursinus*	Common Wombat									B					F	B		
REPTILES																				
Agamidae		*Physignathus lesueurii*	Eastern Water Dragon											O						
Chelidae		*Chelodina longicollis*	Eastern Snake-necked Turtle							O										
Scincidae		*Egernia cunninghami*	Cunningham's Skink														O		O	
Scincidae		*Tiliqua scincoides*	Eastern Blue-tongue			K														
Scincidae		*?Lampropholis* sp.	Litter Skink												O					
Scincidae		*Saproscincus mustelinus*	Weasel Skink									O		O						
?		*?*	Snake																H	
FROGS																				
Hylidae		*Litoria booroolongensis*	Booroolong Frog	E	E															O
Hylidae		*Litoria peronii*	Peron's Tree Frog						W											W

Family	Exotic	Scientific Name	Common Name	Status		Bird survey location														
				TSC Act	EPBC Act	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Myobatrachidae		*Crinia signifera*	Common Eastern Froglet			W			W	W			W					W		
Myobatrachidae		*Limnodynastes dumerilii*	Eastern Banjo Frog									W		W		W	O	W		W
Myobatrachidae		*Crinia parinsignifera*	Eastern Sign-bearing Froglet			W				W							O			W
Myobatrachidae		*Limnodynastes tasmaniensis*	Spotted Grass Frog			W	W		W	W	W						W			W
Myobatrachidae		*Uperoleia laevigata*	Smooth Toadlet						W											

Key: E – endangered, M – migratory, V – vulnerable.

B – burrow; F – tracks and scratchings, H – skin, K – dead, O – observed, P – scat, W – heard

Bat Analysis Results

Scientific name	Common Name	TSC Act	EPBC Act	Call	Survey location								Nesting requirements		
					A1	A2	A3	A4	A5	A6	A7	A8	Hollows	Caves	Artificial
Tadarida australis	White-striped Freetail Bat			D	1		1	1		1	2	3	X		
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V		Pr	1		1						X		
Chalinolobus gouldii	Gould's Wattled Bat			D		2		1					X		
				Pr	1	1			2		1	1	X		
Chalinolobus morio	Chocolate Wattled Bat			D		1	1	1				1	X		
				Pr	1	1		3		1		4	X		
Mormopterus species 4				D			6					5	X		
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V		D		1	3	1		1		8		X	X
				Pr	1		15	3	1			26		X	X
Scotorepens balstoni	Western Broad-nosed Bat			Pr	1			1					X		X
Vespadelus darlingtoni	Large Forest Bat			D			6					2	X		
				Pr			19					6	X		
Vespadelus vulturnus	Little Forest Bat			D		1	17	3	1			11	X		
				Pr		4	1						X		
Vespadelus troughtoni	Eastern Cave Bat	V		Pr								1		X	X
Vespadelus species 43 – 45 khz	Forest bats			✓		2	2		1			19	X		
Nyctophilus spp.	Long-eared bats			✓	1	2						23	X	X	X
Myotis macropus	Large-footed Myotis	V		Pr								8	X	X	X
C.gouldii/Mormopterus species 2				✓								1			
C.gouldii/M. species 4				✓								4			
C.gouldii/Scotorepens balstoni				✓		2		5	9	3		8			
Scoteanax rueppelliii/Scotorepens balstoni				✓			1					1			
Vespadelus species/*M. s. oceanensis*				✓	7	3	158	19	8	1	2	214			
V. vulturnus./M. s. oceanensis				✓	1	6	22	5	5			81			
V. troughtoni/C. morio				✓								1			

Scientific name	Common Name	TSC Act	EPBC Act	Call	Survey location								Nesting requirements		
					A1	A2	A3	A4	A5	A6	A7	A8	Hollows	Caves	Artificial
Nyctophilus sp./*M. Macropus*				✓		1						46			
Other bat calls						7	253	2	16	2	2	120			

Key: V – Vulnerable; Pr – Probable; D – definite; ✓ - species group recorded

Appendix C – Hollow-bearing Tree Data

The following is a comprehensive list of hollow-bearing trees identified within hollow-bearing tree transects conducted within the Study Area during the surveys. The data includes the location of the tree, the species, the height and Diameter at Breast Height (DBH), whether the tree had either Trunk or Branch Hollows, whether the tree has any Crown Dieback and whether there is any evidence of usage of the tree by fauna.

This data relates to Figure 2 in the main body of the report.

Hollow-bearing tree transect data

Location	Tree Species	Height	DBH	Trunk Hollows		Branch Hollows		Evidence of usage	Crown Dieback
		(m)	(cm)	Number	Av diameter (cm)	Number	Av diameter (cm)		
HBT Transect 1	Box	10	50			1	5		Moderate
	Stag	10	60	1	5	3	5		
	Stag	6	50			2	5		
	Box	20	150	1	10	2	5		Moderate
	Blakely	20	80			1	5		Moderate
	Box	15	120	2	20				High
	Blakely	20	90	1	5				Moderate
	Stag	20	120	1	10				
	Blakely	20	150			2	5	small scratches	Moderate
	Blakely	20	120			1	5		High
HBT Transect 2	Stag	10	100			2	5		
	Box	15	110			2	5		High
	Stag	10	40		fissures				
	Stag	10	80	2	10		fissures		
HBT Transect 3	Blakely	20	100			2	5		Moderate
	Box	20	100			2	10		High
	Blakely	20	150			2	5		Moderate
	Stag	15			fissures				Moderate
	Blakely	20	80			2	10		High

Location	Tree Species	Height	DBH	Trunk Hollows		Branch Hollows		Evidence of usage	Crown Dieback
		(m)	(cm)	Number	Av diameter (cm)	Number	Av diameter (cm)		
HBT Transect 4	Box	10	80				fissures		Moderate
	Box	10	80			1	5		Moderate
	Box	20	120	1	5	2	5		Moderate
HBT Transect 5	Blakely	15	60			1	5		Moderate
	Blakely	15	60			3	5		Moderate
	Blakely	20	100	2	10	3	5	whitewash	High
	Blakely	20	120	1	10	2	5	scratches	Moderate
	Blakely	15	80			3	10		Moderate
	Blakely	20	90			1	5		Moderate
	Blakely	20	150			1	5		Moderate
	Blakely	20	80					large scratches	Moderate
	Blakely	20	80			4	5		Moderate
	Stag x 3	10	20			3	10		
	Box	15	100	1	10	2	10		High
HBT Transect 6	Box	20	70	1	10	3	5		Moderate
	Box	20	150			8	5		Moderate
	Box	20	150			10	10		Moderate
	Box	10	20			2	5		Moderate
	Box	20	90			3	10		Moderate
	Box	20	120			7	5		Moderate
	Box	15	120			2	20		Moderate
	Box	15	80	1	10	3	5		Moderate

Location	Tree Species	Height	DBH	Trunk Hollows		Branch Hollows		Evidence of usage	Crown Dieback
		(m)	(cm)	Number	Av diameter (cm)	Number	Av diameter (cm)		
	Box	8	50			4	10		Moderate
	Box	15	70			3	10		Moderate
	Stag	5	40			3	10		Moderate
	Box	10	80	1	10 (base)	1	10		High
HBT Transect 7	Blakley	10	60			2	5		High
	Blakley	10	40			1	10		High
	Stag	6	20	1	10				
	Blakley	10	40	2	10				High
	Stag	3	30	1	10				
	Stag	10	40	1	10	3	5		
	Blakley	10	30			3	5		High
	Stag	10	50	1	10	2	5		
HBT Transect 8	Stag	6	20	2	5	1	5		
	Box	15	80	1	10				High
	Box	10	60			1	5		High
	Stag	6	50			2	5		
	Box	10	70	1	10	1	5		High
	Stag	6	40	1	5	1	5		
	Stag	1	30	1	5				
	Box	15	100	1	20 (base)	1	10		High
	Box	15	40	1	5				High
	Box	20	60			2	5		High

Location	Tree Species	Height	DBH	Trunk Hollows		Branch Hollows		Evidence of usage	Crown Dieback
		(m)	(cm)	Number	Av diameter (cm)	Number	Av diameter (cm)		
HBT Transect 9	Blakely	20	90			4	10	?Glider	Low
	Stag	10	30	1	5				
	Stag	10	50			3	5		
	Box	20	70			4	5		Moderate
	Blakely	20	70	1	10	3	5	?Glider	Moderate
	Blakely	15	60	1	20				Moderate
	Blakely	20	90			4	5		Moderate
	Blakely	20	130			8	10		Moderate

Size classes of trees in 200 m transects

	10-20 cm	20-50 cm	50-80 cm	80-150 cm	150+ cm	Total trees with hollows	Percentage of total
HBT Transect 1	13	7	3	3	4	10	33%
HBT Transect 2	2	5	10	5	1	4	17%
HBT Transect 3	4	4	5	3	1	5	29%
HBT Transect 4	1	1	3	3		3	38%
HBT Transect 5	10	9	3	8	1	11	34%
HBT Transect 6		4	6	7		12	71%
HBT Transect 7	5	15	2			8	36%
HBT Transect 8	7	20	8	2		10	27%
HBT Transect 9	4	2	2	4	?	8	67%

Appendix D – Preliminary Assessments of Significance (TSC Act)

Legislative requirement

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The '7 part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Should the 7 part test conclude that a significant effect is likely, an SIS must be prepared.

Preliminary 7 part tests have been provided for threatened biota of particular concern to provide an indication of the potential level of impact of the proposal. The following threatened biota are included in these assessments:

- Box-gum woodland.
- Koala.
- Booroolong Frog.
- Australian Painted Snipe.
- Woodland birds (Diamond Firetail, Hooded Robin).
- Hollow-dependent microbats.

Preliminary assessments are not provided for species such as the Spotted Harrier and Grey-headed Flying-fox, as these species forage over vast areas, and the proposal would have a very minor impact on their habitat.

Additional threatened fauna are likely to require preparation of 7 part tests once the final route is decided. Preliminary 7 part tests provided below would need to be updated to take into consideration final alignment and design and any additional specific detail on impacts. The size of the pipe, construction methods and pipeline route have not yet been finalised.

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable to this endangered ecological community (EEC).	
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable to this EEC.	
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
The size of the pipe, construction methods and pipeline route have not been finalised. This impact assessment is based on 10 m construction footprint on an indicative route through the centre of the 200 m pipeline corridor. In practice, the final pipeline route could be aligned to avoid some patches of native vegetation within the corridor and so the estimate of impacts is likely to be conservative.	
A total of 36.27 ha of this community occurs in the 200 m wide pipeline corridor. Pipeline route 1 intersects a number of patches of Box-gum woodland in road reserves. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts of up to about 1.8 ha of Box-gum woodland. This is less than 5% of the Box-gum woodland within the pipeline corridor and a very small proportion of the Box-gum woodland in the locality. Construction would remove trees within this 1.8 ha disturbance footprint. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. The construction footprint would be a narrow linear strip over around 30 km.	A total of 25.28 ha of Box-gum woodland is present in the in the 200 m wide pipeline corridor. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the indicative pipeline route, construction should in most cases avoid impacting on trees. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts of up to about 1.2 ha, although this is likely to be an overestimate. This is less than 5% of the Box-gum woodland within the pipeline corridor and a very small proportion of the Box-gum woodland in the locality. Construction would remove trees within this 1.2 ha disturbance footprint. Understorey vegetation would be allowed to regenerate after construction

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
The 1.8 ha of impacts on Box-gum woodland would occur on the edge of remnant patches, mainly within the reserve adjoining Lagoon Road. No patches of Box-gum woodland would be completely removed or isolated. Large remnant patches of over 50 ha in the locality would not be impacted by the proposal, such as near the intersection of Lagoon Road and Bidgerriben Road. These large patches are likely to maintain the viability of the local population of the ecological community. Up to about 1.8 ha of tree removal is unlikely to comprise an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	and would continue to support some of the species within the EEC. The construction footprint would be a narrow linear strip over around 30 km. The 1.2 ha of impacts on Box-gum woodland would occur on the edge of remnant patches, mainly near the eastern end of Bidgerriben Road. No patches of Box-gum woodland would be completely removed or isolated. Large remnant patches of over 100 ha would be retained in the locality, to the north and south of Bidgerriben Road. These large patches are likely to maintain the viability of the local population of the ecological community. Up to about 1.2 ha of tree removal is unlikely to comprise an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Construction would remove trees from up to about 1.8 ha of vegetation. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. Mature trees would play an important role in the EEC through provision of pollen and seeds, foraging resources and shelter. However about 1.8 ha of tree removal would not remove an ecologically significant proportion of mature trees and associated habitat resources in the locality. As stated in b) ii) the local occurrence of Box-gum woodland is likely to be maintained in other extensive patches in the locality. These other patches are likely to contain viable populations of the species which collectively comprise the ecological community.	Construction would remove trees from up to about 1.2 ha of vegetation. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. Mature trees would play an important role in the EEC through provision of pollen and seeds, foraging resources and shelter. However about 1.2 ha of tree removal would not remove an ecologically significant proportion of mature trees and associated habitat resources. As stated in b) ii) the local occurrence of Box-gum woodland is likely to be maintained in other extensive patches in the locality. These other patches are likely to contain viable populations of the species which collectively comprise the ecological community.
d) in relation to the habitat of a threatened species, population or ecological community:	

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
A total of 36.27 ha of this community occurs in the 200 m wide pipeline corridor. The majority of this Box-gum woodland is in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. Assuming a corridor of 10 metres wide, the pipeline construction would remove or modify a maximum 1.8 ha of Box-gum woodland (although this is likely to be an overestimate as discussed above). Construction would remove trees within this 1.8 ha disturbance footprint. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. Based on hollow-bearing tree transects undertaken in these areas, a number of hollow-bearing trees would need to be removed. The number of trees to be removed will depend on the side of the road the alignment would be on, and whether the road reserve is wide enough in these areas to allow for avoidance of some of the trees.	A total of 25.28 ha of Box-gum woodland is present in the200 m pipeline corridor. In some locations, Route 2 passes through or adjacent to patches of Box-gum woodland. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts on a maximum of 1.2 ha, although this is likely to be an overestimate, as discussed above. Construction would remove trees within this 1.2 ha disturbance footprint. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to accomodate the footprint. At this location, there are some very large trees with hollows, however it is likely that the proposal could be aligned to avoid clearing these trees.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The pipeline construction corridor is likely to be up to 10 metres wide. Construction would remove trees within an overall 1.8 ha disturbance footprint over approximately 30 km. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. The majority of the disturbance footprint is in road reserve vegetation parallel to existing gaps in habitat. The pipeline would	The pipeline construction corridor is likely to be up to 10 metres wide. Construction would remove trees within an overall 1.2 ha disturbance footprint over approximately 30 km. Understorey vegetation would be allowed to regenerate after construction and would continue to support some of the species within the EEC. The pipeline would traverse the edges of remnants in most places.

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
traverse the edges of remnants in most places.	
Ecological processes such as pollination, seed fall and movement of fauna would occur across the 10 metre to 20 metre gap in the canopy created by the construction of the pipeline. Understorey vegetation would provide connectivity for many of the ecological processes operating within the EEC. Further, this gap is equivalent to many of the existing, natural gaps between trees given the woodland or open woodland structure of the EEC. No areas of habitat would become fragmented or isolated from other areas of habitat as a result of the proposed action.	
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
The majority of the disturbance footprint is in road reserve vegetation parallel to existing gaps in habitat. The habitat to be modified contains some mature trees, including hollow-bearing trees. Up to about 1.8 ha of tree removal would remove a minor proportion of mature trees and associated habitat resources in the locality. Impacts would occur in less than 5% of the Box-gum woodland within the pipeline corridor and a very small proportion of the Box-gum woodland in the locality. No patches of Box-gum woodland would be completely removed or isolated. Large remnant patches of over 50 ha would not be impacted by the proposal, such as near the intersection of Lagoon Road and Bidgerriben Road. The maximum of 1.8 ha of habitat to be removed or modified is likely to make a minor contribution to the long-term survival of Box-gum woodland in the locality.	Construction would remove or modify habitat from a disturbance footprint of up to about 1.2 ha. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. Impacts would occur in less than 5% of the Box-gum woodland within the pipeline corridor and a very small proportion of the Box-gum woodland in the locality. No patches of Box-gum woodland would be completely removed or isolated. Large remnant patches of over 100 ha, to the north and south of Bidgerriben Road, would not be impacted by the proposal. The maximum of 1.2 ha of habitat to be removed or modified is likely to make a minor contribution to the long-term survival of Box-gum woodland in the locality particularly given the scope to avoid mature trees with this option.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
There is no critical habitat listed for Box-gum woodland.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
There is no recovery plan or threat abatement plan for Box-gum woodland. OEH has identified 29 priority actions to help recover the White Box Yellow Box Blakely's Red Gum Woodland in New South Wales. These actions are concerned with research, community education, mapping, management and weed control. The proposed routes have been aligned through mostly cleared land, thus avoiding impacts on this community along much of the routes. This study provides information to further avoid impacts on this community through the detailed design process. The proposal would not directly affect these priority actions, and through minimising impacts on this community, the proposal is unlikely to interfere with its recovery.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	
The proposed action would contribute to the operation of three KTPs as follows: Clearing of vegetation – the proposal would clear a maximum of 1.8 ha of native vegetation that comprises Box-gum woodland through the permanent removal of the canopy. As stated in c) iii) above, the approximately 1.8 ha of vegetation to be removed or modified is likely to make a minor contribution to the long-term survival of Box-gum woodland in the locality and comprises a minor increase in the operation of this KTP. Removal of hollow-bearing trees – the proposal would remove a number of hollow-bearing trees. Detailed design may be able to reduce the number of hollow-bearing trees that would be removed. Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood within approximately 1.8 ha of native vegetation and occasional isolated dead timber in exotic grassland. Fallen timber would be salvaged as part of the construction and environmental management for the proposal and reinstated in the road reserve and other woodland patches. This would reduce the impacts of the construction process such that the proposed action would result in a minor increase in the operation	The proposed action would contribute to the operation of three KTPs as follows: Clearing of vegetation – the proposal would clear a maximum of 1.2 ha of native vegetation that comprises Box-gum woodland. As stated in c) iii) above, there is considerable scope to avoid mature trees in route option 2 and so the area of permanent removal of the canopy would be less than this figure. Regardless, the approximately 1.2 ha of vegetation to be removed or modified is likely to make a minor contribution to the long-term survival of Box-gum woodland in the locality and would comprise a minor increase in the operation of this KTP. Removal of hollow-bearing trees – the proposal would remove a number of hollow-bearing trees. Detailed design should minimise the number of hollow-bearing trees that would be removed. Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood within approximately 1.2 ha of native vegetation and occasional isolated dead timber in exotic grassland. Fallen timber would be salvaged as part of the construction and environmental management for the proposal and reinstated in the road reserve and other woodland patches. This would reduce the impacts of the construction

Box-gum woodland (Endangered Ecological Community)	
Route 1	Route 2
of this KTP.	process such that the proposed action would result in a minor increase in the operation of this KTP.
Conclusion of Assessment of Significance	
Construction of a pipeline within the Route 1 corridor is unlikely to have a significant impact on Box-gum woodland, pursuant to section 5A of the EP&A Act, as: the proposal would modify a small proportion of the local population of the EEC; impacts would be restricted scattered patches along a narrow, linear strip over around 30 km; and the majority of the disturbance footprint would be parallel to existing roads or cleared land. There is scope to reduce the significance of impacts further, by placing the pipeline in sections of the road reserve that contain fewer mature trees.	Construction of a pipeline within the Route 2 corridor is unlikely to have a significant impact on Box-gum woodland, pursuant to section 5A of the EP&A Act, as: the proposal would modify a small proportion of the local population of the EEC; impacts would be restricted to scattered patches along a narrow, linear strip over around 30 km; and the majority of the disturbance footprint would be parallel to existing cleared land. There is considerable scope to reduce the significance of impacts further, by placing the pipeline in existing easements or tracks that do not contain mature trees.

Booroolong Frog (endangered)	
Route 1	Route 2
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
The Booroolong Frog was recorded on the Macquarie River, about 1 km from Gormans Hill Road. Potential habitat is present near the first crossing of Campbells River. Potential impacts on the Booroolong Frog depend on the method of crossing the river. Directional drilling would have negligible impacts on potential foraging and breeding habitat at Campbells River. This is the preferred method of crossing the river, as it would largely avoid the potential for impacts on potential Booroolong Frog habitat. There may be some indirect impacts on this area of the river from construction of the pipeline in the paddocks, however mitigation measures would be used to minimise the likelihood of erosion and sedimentation. This construction method is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. Trenching the crossing would disturb a small section of pebbled riverbank, which is potential foraging and breeding habitat. Additional areas of potential habitat are present upstream of this location, while little or no potential habitat is present immediately downstream. Trenching of the river would potentially involve temporary damming of part of the river and diversion of the river past the trench. If the Booroolong Frog is present at this location, this method may have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	
Construction of the pipeline along Gormans Hill Road is highly unlikely to have indirect impacts on the known population of Booroolong Frogs, given that the river (and known habitat) is about 1 km from the proposal at this location. The construction of the proposal at this location is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Construction of the pipeline near the Macquarie River may have indirect impacts on Booroolong Frog habitat through erosion and sedimentation. The river is about 300 m from the proposal at this location. Mitigation measures would be used to minimise the likelihood of erosion and sedimentation. The construction of the proposal at this location is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable.	

Booroolong Frog (endangered)	
Route 1	Route 2
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable.	
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
As discussed above, the proposal is unlikely to directly or indirectly impact known or potential Booroolong Frog habitat, provided the pipeline is directionally drilled under Campbells River, and mitigation measures are put in place to limit erosion and sedimentation during construction. If the pipeline is trenched across Campbells River, this would directly impact up to about 5 m^2 of potential breeding and foraging habitat. This method may involve temporarily damming all or part of the river at this location, which would alter flow regimes and heights, potentially impacting upstream habitat.	
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
No area of known or potential habitat would become fragmented or isolated as a result of the proposal.	
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
Potential habitat for the Booroolong Frog is located at the first crossing of Campbells River. Potential habitat in this area occurs as a number of discrete areas of pebbled riverbank, with the largest area (located about 500 m upstream of this point) being about 30 m long by 5 m wide. The area at the crossing location is much smaller. Given the small total area of potential habitat in this area, the area that may be disturbed by trenching the pipeline across the river could be important for the species if a local population is present.	
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	

Booroolong Frog (endangered)	
Route 1	Route 2
There is no critical habitat listed for the	There is no critical habitat listed for the
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
The overall objective of the recovery plan (OEH 2012) is to minimise the probability of extinction of the Booroolong Frog in the wild, and to increase the probability of populations becoming self-sustaining and viable in the longer term. One particular action is to reduce the impact of known or perceived threats contributing to the ongoing decline of the Booroolong Frog. If the pipeline is to be trenched across Campbells River, this would not be consistent with the recovery actions. Directional drilling of the pipeline would be consistent as it would avoid impacts on potential habitat for this species.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	
The proposed action would contribute to the operation of two KTPs as follows: • Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands. The proposal may temporarily alter the natural flow regime of Campbells River if the pipeline is trenched rather than directionally drilled. • Infection of frogs by amphibian chytrid causing the disease chytridiomycosis. The proposal could potentially introduce chytrid fungus to the study area. Mitigation measures are recommended to reduce the likelihood of this occurring.	
Conclusion of Assessment of Significance	
There is a potential for a significant impact on a local population of the Booroolong Frog at Campbells River if the pipeline crossing is trenched at this location and if the frog is present. Directional drilling would avoid this habitat and is unlikely to result in a significant impact. Additional surveys are recommended to determine whether the species occurs at this location.	

Australian Painted Snipe (endangered)	
Route 1	Route 2
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
The pipeline would follow the road reserve adjacent to the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 7.20 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.36 ha may be temporarily disturbed by the proposal.	The pipeline would follow the road reserve adjacent to the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 2.16 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.11 ha may be temporarily disturbed by the proposal.
A pair of Australian Painted Snipe was recorded at the freshwater wetland at The Lagoon. On two occasions, the pair was observed foraging along the waters edge on the far side of the wetland from the road, where a Lantana shrub was providing shelter. A variety of native reeds are present fringing the wetland, also providing shelter. Breeding generally occurs between September and December, although the species can breed at any time of the year. It is possible the pair were breeding at the freshwater wetland given the timing of surveys. The Lantana and fringing reeds provide dense cover for protecting a potential nest. Foraging habitat is present around the perimeter of the wetland. While construction activities could disturb the species (if present during construction), the location where the species was observed is about 100 m from the road, reducing the likelihood of disturbance. Some native reed cover is present near the edges of the road. The extent of reed cover at the road reserve would depend on water level in the wetland at the time of construction of the pipeline. The Australian Painted Snipe is unlikely to breed in vegetation adjacent to the road reserve, and more likely to breed where dense cover is provided by the Lantana on the far edge of the wetland. A very small area of foraging habitat would potentially be impacted by the proposal. Construction of the pipeline is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction as the impact on a small area of the fringe of the wetland would be temporary (wetland vegetation would be able to regenerate following construction). In addition, individual Australian Painted Snipe are more likely to shelter (and potentially breed) on the far side of the wetland where better shelter is present, and minimal foraging habitat would be impacted.	
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable.	

Australian Painted Snipe (endangered)	
Route 1	Route 2
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable.	
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
A total of 7.20 ha of freshwater wetland is present in the pipeline corridor. Of this, only a small proportion (up to about 0.36 ha) may be temporarily disturbed. Wetland vegetation would be rehabilitated following construction.	A total of 2.16 ha of freshwater wetland is present in the pipeline corridor. Of this, only a small proportion (up to about 0.11 ha) may be temporarily disturbed. Wetland vegetation would be rehabilitated following construction.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). Wetland vegetation would be rehabilitated following construction. The pipeline would be located on the very edge of the wetland. As such, the proposal would not fragment or isolate habitat for the Australian Painted Snipe.	
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
The area of wetland vegetation that would be temporarily impacted is located on the edge of the wetland, alongside the road. The main area of wetland occurs further to the west, and the Australian Painted Snipe was recorded on the far side of the wetland from the road reserve. Minimal shelter for the species is located alongside the road reserve, except for an area of reeds near Ryans Lagoon Road. Much of the wetland has fringing vegetation that the species could shelter or breed in. Given these points, the small area that would be impacted is not considered important for the long-term survival of the species in the locality.	

Australian Painted Snipe (endangered)	
Route 1	Route 2
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
No critical habitat has been listed for these species.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
There is no recovery plan for the Australian Painted Snipe. One recovery action has been published by OEH, which relates to undertaking further surveys. The proposed action is therefore not inconsistent with the recovery objective. The proposal is unlikely to affect the recovery of the species given small area of potential habitat to be temporaily modified. Mitigation measures recommended include protecting water quality and rehabilitating vegetation in this area to further reduce potential for impacts.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	
The proposed action would contribute to the operation of one KTP as follows: • Clearing of vegetation – the proposal would remove a small area (up to about 0.36 ha) of native vegetation that represents foraging habitat and potential breeding habitat for this species. Mitigation measures are proposed to minimise the impact of this disturbance.	The proposed action would contribute to the operation of one KTP as follows: • Clearing of vegetation – the proposal would remove a small area (up to about 0.11 ha) of native vegetation that represents foraging habitat and potential breeding habitat for this species. Mitigation measures are proposed to minimise the impact of this disturbance.
Conclusion of Assessment of Significance	
The proposal is unlikely to have a significant impact on the Australian Painted Snipe, pursuant to section 5A of the EP&A Act, as the proposal would only impact a very minor area of wetland habitat immediately adjacent to the road.	The proposal is unlikely to have a significant impact on the Australian Painted Snipe, pursuant to section 5A of the EP&A Act, as the proposal would only impact a very minor area of wetland habitat immediately adjacent to the road.

Koala (vulnerable)	
Route 1	Route 2
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
Native vegetation in the study area consists mainly of secondary feed trees of the Koala (Blakely's Red Gum, Yellow Box and Apple Box), with primary feed trees (Mountain Gum) located only in the southern part of the study area. No Koalas were observed during surveys, but are seen on occasion by local residents, particularly in the area around Bidgeribbin Road. A small number of records are located in this area according to the NSW Wildlife Atlas (OEH 2012a). Core Koala habitat is likely to occur to the south-west of the study area near Rockley Mount, where numerous records of Koalas are located.	
Koalas would forage throughout larger patches of vegetation along Lagoon Road. It is possible that the species may breed in this area. The proposal is likely to require removal of trees along parts of the road reserve. Possible removal of a strip of vegetation from along the road reserve of Lagoon Road would have a minor impact on foraging habitat, as the vegetation is continuous with patches in adjacent paddocks. Similarly, only a very small area of potential breeding habitat would be removed, with large areas of potential breeding habitat present in adjacent paddocks. While the road reserve provides some continuity of vegetation in this area, the proposal would not create gaps or fragment Koala habitat to the degree that any areas become isolated. As such, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Koalas would forage throughout larger patches of vegetation near Bidgeribbin Road. It is possible that the species may breed in this area. It is likely that only a few trees would be removed, particularly as the route follows an electricity easement through one patch, an access track through another, and skirts along the edges of a number of patches. Thus only a very small area of potential foraging and breeding habitat would be removed. The proposal would not create gaps or fragment Koala habitat to the degree that any areas become isolated. As such, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable.	Not applicable.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	

Koala (vulnerable)	
Route 1	Route 2
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable.	Not applicable.
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
A total of 44.82 ha of woodland vegetation occurs in the 200 m wide pipeline corridor. The majority of this woodland is in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. Assuming a corridor of 10 metres wide, the pipeline construction would remove or modify up to about 2.2 ha of woodland (although this is likely to be an overestimate as discussed above). Construction would remove Koala feed trees within this 2.2 ha disturbance footprint.	A total of 31.12 ha of woodland vegetation is present in the 200 m pipeline corridor. In some locations, Route 2 passes through or adjacent to patches of Box-gum woodland. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts on up to about 1.6 ha, although this is likely to be an overestimate, as discussed above. Construction would remove Koala feed trees within this 1.6 ha disturbance footprint. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to accomodate the footprint
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The road reserve provides some continuity of vegetation, and thus Koala habitat, along Lagoon Road. Adjacent paddocks also contain larger patches of similar vegetation. While the proposal would reduce connectivity along the road	Potential Koala habitat along the river route occurs as woodland patches with limited connectivity with each other, although there is some continuity with other patches in adjacent paddocks. The removal of some trees from

Koala (vulnerable)	
Route 1	Route 2
reserve, it would not create gaps or fragment Koala habitat to the degree that any areas become isolated.	the edges of patches would not create gaps or fragment Koala habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
The potential habitat in the study area is dominated by secondary feed trees, with some small patches containing primary feed trees near Chifley Dam. Koalas are seen on occasion in the Bidgeribbin Road area, and would use this vegetation for foraging and potentially breeding. The small area of habitat along the road reserve is not considered important, given that adjacent paddocks contain larger patches of feed trees, and Koalas would still be able to move through the area despite the loss of some habitat in the road reserve.	The potential habitat in the study area is dominated by secondary feed trees, with some small patches containing primary feed trees near Chifley Dam. Koalas are seen on occasion in the Bidgeribbin Road area, and would use this vegetation for foraging and potentially breeding. The small area of habitat along the edges of patches that may be removed is not considered important, given that removal of these trees would not interrupt connectivity with other areas of habitat.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
There is no critical habitat listed for the Koala.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
The overall objective of the recovery plan is to reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range. The proposal would remove a very narrow strip of vegetation from along one side of a road reserve. This would have a minor impact on foraging and breeding habitat. Movement of Koalas in the area will still be possible. While the proposal is not consistent with the recovery objective, the proposal is unlikely to interfere substantially with the recovery of the Koala.	The overall objective of the recovery plan is to reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range. The proposal may remove occasional trees from along the edges of habitat patches. This would have a minor impact on foraging and breeding habitat. Movement of Koalas in the area will still be possible. While the proposal is not consistent with the recovery objective, the proposal is unlikely to interfere substantially with the recovery of the Koala.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key	

Koala (vulnerable)	
Route 1	Route 2
threatening process	
The proposed action would contribute to the operation of one KTP as follows: • Clearing of vegetation – the proposal would remove up to about 2.2 ha of Koala habitat.	The proposed action would contribute to the operation of one KTP as follows: • Clearing of vegetation – the proposal would remove up to about 2.2 ha of Koala habitat.
Conclusion of Assessment of Significance	
The proposal is unlikely to have a significant impact on the Koala, pursuant to section 5A of the EP&A Act, given that only a small area of habitat would be removed, and that the proposal would not prevent movement of Koalas through the study area and surrounds.	The proposal is unlikely to have a significant impact on the Koala, pursuant to section 5A of the EP&A Act, given that only a few trees along the edges of patches may be removed, and that the proposal would not prevent movement of Koalas through the study area and surrounds.

Small woodland birds (eg Diamond Firetail)	
Route 1	Route 2
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
Diamond Firetails were recorded in woodland near Chifley Dam and near Bidgeribbin Road. Other small threatened woodland birds are also likely to occur, such as the Hooded Robin, Varied Sittella, Speckled Warbler, Scarlet Robin and Flame Robin. These species may breed in larger woodland remnants, and would also forage in these areas and potentially other smaller remnants.	
The proposal is likely to require removal of trees along parts of the road reserve. Possible removal of a strip of vegetation from along the road reserve of Lagoon Road would have a minor impact on foraging habitat, as the vegetation is continuous with patches in adjacent paddocks, and groundcover would be able to regenerate following construction. Similarly, only a very small area of potential breeding habitat would be removed, with areas of potential breeding habitat remaining in the road reserve and present in adjacent paddocks. While the road reserve provides some continuity of vegetation in this area, the proposal would not create gaps or fragment habitat for these species to the degree that any areas become isolated. As such, the proposal is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.	The proposal is likely that only a few trees would be removed, particularly as the route follows an electricity easement through one patch, an access track through another, and skirts along the edges of a number of patches. Thus only a very small area of potential foraging and breeding habitat would be removed. and groundcover would be able to regenerate following construction. The proposal would not create gaps or fragment habitat for these species to the degree that any areas become isolated. As such, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable.	
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	

Small woodland birds (eg Diamond Firetail)	
Route 1	Route 2
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable.	
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
A total of 46.93 ha of woodland habitat occurs in the 200 m wide pipeline corridor. The majority of this woodland is in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. Assuming a corridor of 10 metres wide, the pipeline construction would remove or modify up to about 2.3 ha of woodland habitat (although this is likely to be an overestimate as discussed above).	A total of 40.76 ha of woodland habitat is present in the 200 m pipeline corridor. In some locations, Route 2 passes through or adjacent to patches of Box-gum woodland. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts on up to about 2 ha, although this is likely to be an overestimate, as discussed above. Construction would remove woodland habitat within this 2 ha disturbance footprint. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to accomodate the footprint
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The road reserve provides some continuity of vegetation, and thus woodland bird habitat, along Lagoon Road. Adjacent paddocks also contain larger patches of similar vegetation. While the proposal would reduce connectivity	Woodland bird habitat along the river route occurs as patches with limited connectivity with each other, although there is some continuity with other patches in adjacent paddocks. The removal of some trees from the edges

Small woodland birds (eg Diamond Firetail)	
Route 1	Route 2
along the road reserve, it would not create gaps or fragment woodland bird habitat to the degree that any areas become isolated.	of patches would not create gaps or fragment woodland bird habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
Woodland bird habitat along the road reserves and near Campbells River includes isolated patches of woodland with varying levels of understorey. Woodland birds could forage and breed in the road reserve, and in adjacent woodland areas. The small area of potential breeding and foraging habitat that would be removed is minor compared to the size of adjacent patches. Foraging habitat on the ground would be temporarily disturbed, but would be rehabilitated following construction. No areas of known or potential habitat would become isolated as a result of the proposal. As such the area that would be impacted is not considered important for the long-term survival of these woodland bird species.	Woodland bird habitat in paddocks includes isolated patches of woodland with varying levels of understorey. Woodland birds could forage and breed in the road reserve, and in adjacent woodland areas. The small area of potential breeding and foraging habitat that would be removed is minor compared to the size of adjacent patches. Foraging habitat on the ground would be temporarily disturbed, but would be rehabilitated following construction. No areas of known or potential habitat would become isolated as a result of the proposal. As such the area that would be impacted is not considered important for the long-term survival of these woodland bird species.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
No critical habitat has been listed for these species.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
No recovery plans have been prepared for these species. Priority actions mainly relate to management of key populations and the enhancement of habitat. The proposal would remove habitat for these species and is therefore not consistent with the recovery actions. Council could consider planting programs to enhance habitat for these species, such as at Chifley Dam.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	
The proposed action would contribute to the operation of two KTPs as	The proposed action would contribute to the operation of two KTPs as

Small woodland birds (eg Diamond Firetail)	
Route 1	Route 2
follows: • Clearing of vegetation – the proposal would remove a small area (up to about 2.3 ha) of native vegetation that represents foraging habitat and potential breeding habitat for these species. • Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood. Fallen timber would be salvaged from construction footprint and relocated in adjoining areas.	follows: • Clearing of vegetation – the proposal would remove a small area (up to about 2 ha) of native vegetation that represents foraging habitat and potential breeding habitat for these species. • Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood. Fallen timber would be salvaged from construction footprint and relocated in adjoining areas.
Conclusion of Assessment of Significance	
The proposal is unlikely to have a significant impact on small woodland birds, pursuant to section 5A of the EP&A Act, given that only a small area of habitat would be removed, and the birds would continue to be able to move through the study area and surrounds.	

Hollow-roosting microbats	
Route 1	Route 1
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
The Yellow-bellied Sheathtail Bat and Large-footed Myotis were probably recorded in the study area. The Yellow-bellied Sheathtail Bat may breed in hollow-bearing trees in the study area, and would forage in woodland and cleared areas. The Large-footed Myotis breeds in caves, but can roost in hollows, and forages above rivers and large dams. The proposal is likely to require removal of hollow-bearing trees along parts of the road reserve that may provide roosting or nesting habitat for these species. Hollow-bearing trees also occur in adjacent woodland patches. Both species are also known to roost in other habitats, such as animal burrows (Yellow-bellied Sheathtail Bat) or caves and culverts (Large-footed Myotis).	
Disturbance of a strip of vegetation from along the road reserve of Lagoon Road would have a minor impact on foraging habitat for the Yellow-bellied Sheathtail Bat, as the vegetation is continuous with patches in adjacent paddocks, and groundcover would be rehabiliated following construction. This species can also forage over cleared land. The proposal would have minimal impact on the foraging habitat of the Large-footed Myotis, which forages over large waterways. While the road reserve provides some continuity of vegetation in this area, the proposal would not create gaps or fragment habitat for these species to the degree that any areas become isolated. The proposal is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction, as hollow-bearing trees will remain in the study area, and minimal foraging habitat would be removed.	Disturbance of a strip of groundcover would have a negligible impact on foraging habitat, as for the Yellow-bellied Sheathtail Bat can also forage over cleared land and waterbodies. The proposal would have minimal impact on the foraging habitat of the Large-footed Myotis, which forages over large waterways. While there is some continuity of vegetation in this area, the proposal would not create gaps or fragment habitat for these species to the degree that any areas become isolated. The proposal is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction, as few hollow-bearing trees are likely to be removed, and minimal foraging habitat would be disturbed.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that	

Hollow-roosting microbats	
Route 1	Route 1
constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable.	
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable.	
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
A total of 46.93 ha of woodland habitat occurs in the 200 m wide pipeline corridor. The majority of this woodland is in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. Assuming a corridor of 10 metres wide, the pipeline construction would remove or modify up to about 2.3 ha of woodland habitat (although this is likely to be an overestimate as discussed above).	A total of 40.76 ha of woodland habitat is present in the 200 m pipeline corridor. In some locations, Route 2 passes through or adjacent to patches of Box-gum woodland. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts on up to about 2 ha, although this is likely to be an overestimate, as discussed above. Construction would remove woodland habitat within this 2 ha disturbance footprint. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to accomodate the footprint

Hollow-roosting microbats	
Route 1	Route 1
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The road reserve provides some continuity of vegetation along Lagoon Road. Microbats are highly mobile, and are able to traverse and forage over cleared land and waterways. While the proposal would reduce connectivity along the road reserve, it would not create gaps or fragment microbat habitat to the degree that any areas become isolated.	Microbat habitat along the river route occurs as patches of vegetation with limited connectivity with each other, although there is some continuity with other patches in adjacent paddocks. Microbats are highly mobile, and are able to traverse and forage over cleared land and waterways. The removal of some trees from the edges of patches would not create gaps or fragment microbat habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
Microbat habitat along the road reserves and near Campbells River includes isolated patches of woodland with varying levels of understorey. Microbats could forage and roost in the road reserve, and in adjacent woodland areas. The small area of potential breeding and foraging habitat that would be removed is minor compared to the size of adjacent patches. Foraging habitat on the ground would be temporarily disturbed, but would be rehabilitated following construction. There would be minimal impact on foraging habitat of the Large-footed Myotis. No areas of known or potential habitat would become isolated as a result of the proposal. As such the area that would be impacted is not considered important for the long-term survival of these microbat species.	Microbat habitat in paddocks includes isolated patches of woodland with varying levels of understorey. Microbats could forage and roost in the road reserve, and in adjacent woodland areas. The small area of potential breeding and foraging habitat that would be removed is minor compared to the size of adjacent patches. Foraging habitat on the ground would be temporarily disturbed, but would be rehabilitated following construction. There would be minimal impact on foraging habitat of the Large-footed Myotis. No areas of known or potential habitat would become isolated as a result of the proposal. As such the area that would be impacted is not considered important for the long-term survival of these microbat species.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
No critical habitat has been listed for these species.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
No recovery plans have been prepared for these species. Priority actions mainly relate to further research and retention of hollow-bearing trees. The proposal	

Hollow-roosting microbats	
Route 1	Route 1
would remove habitat for these species and is therefore not consistent with the recovery actions. The pipeline has been located in an area dominated by cleared land, minimise the removal of hollow-bearing trees. Removal of hollow-bearing trees should be further avoided where possible during detailed design of preferred alignment.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	
The proposed action would contribute to the operation of two KTPs as follows: • Clearing of vegetation – the proposal would remove a small area (up to about 2.3 ha) of native vegetation that represents foraging habitat and potential breeding habitat for these species. • Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood. Fallen timber should be retained in the road reserve and other woodland patches. • Removal of hollow-bearing trees – the proposal would remove a number of hollow-bearing trees.	The proposed action would contribute to the operation of two KTPs as follows: • Clearing of vegetation – the proposal would remove a small area (up to about 2 ha) of native vegetation that represents foraging habitat and potential breeding habitat for these species. • Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood. Fallen timber should be retained in the road reserve and other woodland patches. • Removal of hollow-bearing trees – the proposal may remove a number of hollow-bearing trees, although detailed design of the route may be able to avoid this impact.
Conclusion of Assessment of Significance	
The proposal is unlikely to have a significant impact on hollow-roosting microbats, pursuant to section 5A of the EP&A Act, given that only a small area of habitat would be removed, the species are able to roost in other habitat features, and minimal foraging habitat would be disturbed.	

Appendix E – Preliminary Assessments of Significance (EPBC Act)

Legislative requirement

Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a MNES. Preliminary assessments of significance have been prepared for key MNES in accordance with the EPBC Act Significant Impact Guidelines (DEWHA 2009) to provide an indication of the potential level of impact of the proposal. The following threatened biota are included in these assessments:

- Koala.
- Booroolong Frog.
- Australian Painted Snipe.

Preliminary assessments are not provided for species such as the Grey-headed Flying-fox and migratory species, as these species occur over vast areas, and the proposal would have a very minor impact on their habitat.

Additional threatened biota may require preparation of assessments of significance once the final route is decided on. Preliminary assessments of significance provided below would need to be updated to take into consideration final alignment and design and any additional specific detail on impacts. The size of the pipe, construction methods and pipeline route have not yet been finalised.

Koala (Vulnerable)	
Route 1	Route 2
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will: lead to a long-term decrease in the size of an important population of a species	
Native vegetation in the study area consists mainly of secondary feed trees of the Koala (Blakely's Red Gum, Yellow Box and Apple Box), with primary feed trees (Mountain Gum) located only in the southern part of the study area. No Koalas were observed during surveys, but are seen on occasion by local residents, particularly in the area around Bidgeribbin Road. A small number of records are located in this area according to the NSW Wildlife Atlas (OEH 2012a). Core Koala habitat is likely to occur to the south-west of the study area near Rockley Mount, where numerous records of Koalas are located.	
The small area of habitat along the road reserve is not considered important, given that adjacent paddocks contain larger patches of feed trees, and Koalas would still be able to move through the area despite the loss of some habitat in the road reserve. Given the small area of foraging and movement habitat that would be impacted, the lack of breeding habitat and the continued presence of a movement corridor in the area, the proposal is unlikely to lead to a long-term decrease in the size of an important population of the Koala.	The small area of habitat along the edges of patches that may be removed is not considered important, given that removal of these trees would not interrupt connectivity with other areas of habitat. Given the small area of foraging and movement habitat that would be impacted, the lack of breeding habitat and the continued presence of a movement corridor in the area, the proposal is unlikely to lead to a long-term decrease in the size of an important population of the Koala.
Reduce the area of occupancy of an important population	
The proposal would result in the loss of about 2.2 ha of foraging and movement habitat that occurs in the road reserve. Existing connectivity would not be severed. The proposal is unlikely to reduce the area of occupancy of an important population of Koalas.	The proposal would result in the loss of about 1.6 ha of foraging and movement habitat that occurs in the road reserve. Existing connectivity would not be severed. The proposal is unlikely to reduce the area of occupancy of an important population of Koalas.
Fragment an existing important population into two or more populations	
The road reserve provides some continuity of vegetation, and thus Koala habitat, along Lagoon Road. Adjacent paddocks also contain larger patches of similar vegetation. While the proposal would reduce connectivity along the road	Potential Koala habitat along the river route occurs as woodland patches with limited connectivity with each other, although there is some continuity with other patches in adjacent paddocks. The removal of some trees from

Koala (Vulnerable)	
Route 1	Route 2
reserve, it would not create gaps or fragment Koala habitat to the degree that any areas become isolated. The proposal is therefore unlikely to fragment an existing important population into two or more populations.	the edges of patches would not create gaps or fragment Koala habitat. The proposal is therefore unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	
According to the interim referral guidelines for the Koala (DSEWPaC 2012c), habitat critical to the survival of the Koala include areas of forest or woodland where: • primary koala food tree species comprise at least 30% of the overstorey trees, • primary koala food tree species comprise less than 30% of the overstorey trees, but together with secondary food tree species comprise at least 50% of the overstorey trees, • primary food tree species are absent but secondary food tree species alone comprise at least 50% of the overstorey trees, • the above qualities may be absent in a forest or woodland but other essential habitat features are present and adjacent to areas exhibiting the above qualities, • a relatively high density of koalas is supported, regardless of the presence of food tree species, or • any form of landscape corridor which is essential to the dispersal of koalas between forest or woodland habitats. Few primary feed trees are present in the study area, however secondary feed trees dominate the woodland patches. Habitat is therefore considered habitat critical to the survival of the species. Given the small area of habitat that would be impacted, the lack of breeding habitat and the continued presence of a movement corridor in the area, the proposal is unlikely to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of an important population	
Koalas would forage throughout larger patches of vegetation along Lagoon Road. It is possible that the species may breed in this area. The proposal is likely to require removal of trees along parts of the road reserve. Possible	Koalas would forage throughout larger patches of vegetation near Bidgeribbin Road. It is possible that the species may breed in this area. It is likely that only a few trees would be removed, particularly as the route

Koala (Vulnerable)	
Route 1	Route 2
removal of a strip of vegetation from along the road reserve of Lagoon Road would have a minor impact on foraging habitat, as the vegetation is continuous with patches in adjacent paddocks. Similarly, only a very small area of potential breeding habitat would be removed, with large areas of potential breeding habitat present in adjacent paddocks. While the road reserve provides some continuity of vegetation in this area, the proposal would not create gaps or fragment Koala habitat to the degree that any areas become isolated. Given the above points, the proposal is unlikely to disrupt the breeding cycle of an important population of the Koala.	follows an electricity easement through one patch, an access track through another, and skirts along the edges of a number of patches. Thus only a very small area of potential foraging and breeding habitat would be removed. The proposal would not create gaps or fragment Koala habitat to the degree that any areas become isolated. As such, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. Given the above points, the proposal is unlikely to disrupt the breeding cycle of an important population of the Koala.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	
A total of 44.82 ha of woodland vegetation occurs in the 200 m wide pipeline corridor. The majority of this woodland is in the road reserve of Lagoon Road, particularly in the vicinity of Bidgeribbin Road and Perthville Road. Assuming a corridor of 10 metres wide, the pipeline construction would remove or modify up to about 2.2 ha of woodland (although this is likely to be an overestimate as discussed above). Construction would remove Koala feed trees within this 2.2 ha disturbance footprint. Given the above points, the proposal is unlikely to remove or decrease the availability or quality of habitat such that the Koala is likely to decline.	A total of 31.12 ha of woodland vegetation is present in the 200 m pipeline corridor. In some locations, Route 2 passes through or adjacent to patches of Box-gum woodland. Assuming a construction corridor 10 metres wide, the pipeline could result in impacts on up to about 1.6 ha, although this is likely to be an overestimate, as discussed above. Construction would remove Koala feed trees within this 1.6 ha disturbance footprint. Due to the narrow construction footprint of the pipeline, and the location of most woodland patches in relation to the river, the pipeline should in most cases avoid removing mature trees. In one location, the pipeline is likely to follow an electricity easement through the woodland, and thus should avoid impacting on trees. At a location south of Bidgeribbin Road where the woodland patch comes down to the river, an access track is present that should be able to accommodate the footprint. Given the above points, the proposal is unlikely to remove or decrease the availability or quality of habitat such that the Koala is likely to decline.

Koala (Vulnerable)	
Route 1	Route 2
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	
The study area is located in a mainly agricultural landscape. A range of pasture species and other weeds are present in the study area, and dogs and foxes are also present in the area. The proposal is unlikely to increase the incidence of these invasive species, or introduce new invasive species to the Koala habitat in the area.	
Introduce disease that may cause the species to decline, or	
The proposal is unlikely to introduce diseases such as Chlamydia (which affects Koalas) or Phytophthora (which affects their habitat) that may cause the species to decline.	
Interfere substantially with the recovery of the species	
The overall objective of the recovery plan is to reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range. The proposal would remove a very narrow strip of vegetation from along one side of a road reserve. This would have a minor impact on foraging and breeding habitat. Movement of Koalas in the area will still be possible. The proposal is unlikely to increase the risk of vehicle-related fatalities in study area. While the proposal is not consistent with the recovery objective, the proposal is unlikely to interfere substantially with the recovery of Koalas.	
Conclusion of assessment of significance	
The proposal is not 'likely' to have a 'significant impact' on the Koala that only a small area of habitat would be removed, and that the proposal would not prevent movement of Koalas through the study area and surrounds.	

Australian Painted Snipe (Vulnerable)	
Route 1	Route 2
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will: lead to a long-term decrease in the size of an important population of a species	
The pipeline would follow the road reserve adjacent to the freshwater wetland. A pair of Australian Painted Snipe was recorded at the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 7.20 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.36 ha may be temporarily disturbed by the proposal.	The pipeline would follow the road reserve adjacent to the freshwater wetland. A pair of Australian Painted Snipe was recorded at the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 2.16 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.11 ha may be temporarily disturbed by the proposal.
The area of wetland vegetation that would be temporarily impacted is located on the edge of the wetland, alongside the road. The main area of wetland occurs further to the west, and the Australian Painted Snipe was recorded on the far side of the wetland from the road reserve. Minimal shelter for the species is located alongside the road reserve, except for an area of reeds near Ryans Lagoon Road. Much of the wetland has fringing vegetation that the species could shelter or breed in. Given these points, the small area that would be impacted is unlikely to lead to a long-term decrease in the size of an important population of a species.	
Reduce the area of occupancy of an important population	
Up to about 0.36 ha of fringing vegetation may be temporarily disturbed by the proposal. The majority of the wetland will not be directly impacted. The proposal is unlikely to reduce the area of occupancy of an important population of Australian Painted Snipe.	Up to about 0.11 ha of fringing vegetation may be temporarily disturbed by the proposal. The majority of the wetland will not be directly impacted. The proposal is unlikely to reduce the area of occupancy of an important population of Australian Painted Snipe.
Fragment an existing important population into two or more populations	
The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). Wetland vegetation would be rehabilitated following construction. The pipeline would be located on the very edge of the wetland. As such, the proposal would not fragment or isolate habitat for the Australian Painted Snipe. The proposal is therefore unlikely to fragment an existing important population into two or more populations.	

Australian Painted Snipe (Vulnerable)	
Route 1	Route 2
Adversely affect habitat critical to the survival of a species	
No critical habitat has been listed for the Australian Painted Snipe. Australian Painted Snipe appear to require the following breeding habitat: shallow wetlands with areas of bare wet mud, dense low cover and sometimes some tall dense cover (DSEWPAC 2012a). On two occasions, the pair was observed foraging along the waters edge on the far side of the wetland from the road, where a Lantana shrub was providing shelter. It is likely that the species uses this wetland for breeding. This habitat is therefore considered critical to the survival of the species. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most) on the far side of the wetland from where the Australian Painted Snipe were observed, in an area with little reed cover. While construction activities could disturb the species (if present during construction), the location where the species was observed is about 100 m from the road, reducing the likelihood of disturbance. The area would be rehabilitated following construction. As such, the proposal is unlikely to adversely affect habitat critical to the survival of a species.	
Disrupt the breeding cycle of an important population	
A pair of Australian Painted Snipe was recorded at the freshwater wetland at The Lagoon. On two occasions, the pair was observed foraging along the waters edge on the far side of the wetland from the road, where a Lantana shrub was providing shelter. A variety of native reeds are present fringing the wetland, also providing shelter. Breeding generally occurs between September and December, although the species can breed at any time of the year. It is possible the pair were breeding at the freshwater wetland given the timing of surveys. The Lantana and fringing reeds provide dense cover for protecting a potential nest. Foraging habitat is present around the perimeter of the wetland. While construction activities could disturb the species (if present during construction), the location where the species was observed is about 100 m from the road, reducing the likelihood of disturbance. Some native reed cover is present near the edges of the road. The extent of reed cover at the road reserve would depend on water level in the wetland at the time of construction of the pipeline. The Australian Painted Snipe is unlikely to breed in vegetation adjacent to the road reserve, and more likely to breed where dense cover is provided by the Lantana on the far edge of the wetland. A very small area of foraging habitat would potentially be impacted by the proposal. Construction of the pipeline is unlikely to disrupt the breeding cycle of an important population as the impact on a small area of the fringe of the wetland would be temporary (wetland vegetation would be able to regenerate following construction). In addition, individual Australian Painted Snipe are more likely to shelter (and potentially breed) on the far side of the wetland where better shelter is present, and minimal foraging habitat would be impacted.	
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	

Australian Painted Snipe (Vulnerable)	
Route 1	Route 2
The pipeline would follow the road reserve adjacent to the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 7.20 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.36 ha may be temporarily disturbed by the proposal.	The pipeline would follow the road reserve adjacent to the freshwater wetland. The construction of the pipeline would impact only a very narrow corridor (up to 10 m in width at most). While 2.16 ha of freshwater wetland is present in the pipeline corridor, only up to about 0.11 ha may be temporarily disturbed by the proposal.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	
The study area is located in a mainly agricultural landscape. A range of pasture species and other weeds are present in the study area, and dogs and foxes are also present in the area. The proposal is unlikely to increase the incidence of these invasive species, or introduce new invasive species to the Koala habitat in the area.	
Introduce disease that may cause the species to decline, or	
The proposal is unlikely to introduce diseases that may cause the species to decline.	
Interfere substantially with the recovery of the species	
There is no recovery plan for the Australian Painted Snipe. One recovery action has been published by OEH, which relates to undertaking further surveys. The proposed action is therefore not inconsistent with the recovery objective. The proposal is unlikely to interefere substantially with the recovery of the species given small area of potential habitat to be temporarily modified. Mitigation measures recommended include protecting water quality and rehabilitating vegetation in this area to further reduce potential for impacts.	
Conclusion of assessment of significance	
The proposal is unlikely to have a significant impact on the Australian Painted Snipe, pursuant to the significant impact guidelines (DEWHA 2009), as the proposal would only impact a very minor area of wetland habitat immediately adjacent to the road.	

Booroolong Frog (Endangered)	
Route 1	Route 2
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will: lead to a long-term decrease in the size of a population of a species	
The Booroolong Frog was recorded on the Macquarie River, about 1 km from Gormans Hill Road. Potential habitat for the Booroolong Frog is located at the first crossing of Campbells River. Potential habitat in this area occurs as a number of discrete areas of pebbled riverbank, with the largest area (located about 500 m upstream of this point) being about 30 m long by 5 m wide. The area at the crossing location is much smaller. Given the small total area of potential habitat in this area, the area that may be disturbed by trenching the pipeline across the river could be important for the species if a local population is present. Trenching of this habitat could therefore result in a long-term decrease in the size of a population of the species. As such, the preferred option at this location would be to directionally drill the pipeline, as this would avoid impacts on the potential habitat for the species, and would therefore be unlikely to result in a long-term decrease in the size of a population of the species.	
Construction of the pipeline along Gormans Hill Road is highly unlikely to have indirect impacts on the known population of Booroolong Frogs, given that the river (and known habitat) is about 1 km from the proposal at this location. The proposal is unlikely to result in a long-term decrease in the size of a population of the species at this location.	Construction of the pipeline near the Macquarie River may have indirect impacts on Booroolong Frog habitat through erosion and sedimentation. The river is about 300 m from the proposal at this location. Mitigation measures would be used to minimise the likelihood of erosion and sedimentation. The proposal is unlikely to result in a long-term decrease in the size of a population of the species at this location.
Reduce the area of occupancy of the species	
As discussed above, the proposal is unlikely to directly or indirectly impact known or potential Booroolong Frog habitat, provided the pipeline is directionally drilled under Campbells River, and mitigation measures are put in place to limit erosion and sedimentation during construction. If the pipeline is trenched across Campbells River, this would directly impact up to about 5 m^2 of potential breeding and foraging habitat. This method may involve temporarily damming all or part of the river at this location, which would alter flow regimes and heights, potentially impacting upstream habitat. This is unlikely to reduce the area of occupancy of the species.	

Booroolong Frog (Endangered)	
Route 1	Route 2
Fragment an existing population into two or more populations	
No area of known or potential habitat would become fragmented or isolated as a result of the proposal	
Adversely affect habitat critical to the survival of a species	
No critical habitat has been listed for the Booroolong Frog. Adults occur on or near cobble banks and other rock structures within stream margins and shelter under rocks or amongst vegetation near the ground on the stream edge (DSEWPAC 2012a). Cooble banks are present on Campbells River, west of Chifley Dam, and in a section of the Macquarie River. The proposal is unlikely to indirectly impact the area where the species was recorded on the Macquarie River. Potential habitat on Cambells River could be impacted if the pipeline is trenched at this location. This could adversely affect habitat critical to the survival of the species. If the pipeline is directionally drilled at this location, the proposal would not adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of a population	
The Booroolong Frog was recorded on the Macquarie River, about 1 km from Gormans Hill Road. Possible indirect impacts at this location are unlikely to disrupt the breeding cycle of the population. Potential habitat is present near the first crossing of Campbells River. Potential impacts on the Booroolong Frog depend on the method of crossing the river. Directional drilling would have negligible impacts on potential foraging and breeding habitat at Campbells River. This is the preferred method of crossing the river, as it would largely avoid the potential for impacts on potential Booroolong Frog habitat. There may be some indirect impacts on this area of the river from construction of the pipeline in the paddocks, however mitigation measures would be used to minimise the likelihood of erosion and sedimentation. This construction method is unlikely to disrupt the breeding cycle of the population. Trenching the crossing would disturb a small section of pebbled riverbank, which is potential foraging and breeding habitat. Additional areas of potential habitat are present upstream of this location, while little or no potential habitat is present immediately downstream. Trenching of the river would potentially involve temporary damming of part of the river and diversion of the river past the trench. If the Booroolong Frog is present at this location, this method may disrupt the breeding cycle of the population.	
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	
As discussed above, the proposal is unlikely to directly or indirectly impact known or potential Booroolong Frog habitat, provided the pipeline is directionally drilled under Campbells River, and mitigation measures are put in place to limit erosion and sedimentation during construction. This method is unlikely to	

Booroolong Frog (Endangered)	
Route 1	Route 2
cause the species to decline. If the pipeline is trenched across Campbells River, this would directly impact up to about 5 m^2 of potential breeding and foraging habitat. This method may involve temporarily damming all or part of the river at this location, which would alter flow regimes and heights, potentially impacting upstream habitat. This method could cause substantial damage to an area of potential habitat, which could cause the spseceis to decline.	
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	
The study area is located in a mainly agricultural landscape. A range of pasture species and other weeds are present in the study area, and dogs and foxes are also present in the area. The proposal is unlikely to increase the incidence of these invasive species, or introduce new invasive species to the Koala habitat in the area.	
Introduce disease that may cause the species to decline, or	
The proposal could introduce diseases such as Chitrid fungus that may cause the species to decline. Mitigation measures are recommended to reduce the likelihood of the introduction of this disease into the study area.	
Interfere substantially with the recovery of the species	
The overall objective of the recovery plan (OEH 2012) is to minimise the probability of extinction of the Booroolong Frog in the wild, and to increase the probability of populations becoming self-sustaining and viable in the longer term. One particular action is to reduce the impact of known or perceived threats contributing to the ongoing decline of the Booroolong Frog. If the pipeline is to be trenched across Campbells River, this may interfere with the recovery of the species (if present at this location). Directional drilling of the pipeline would not interfere with the recovery of the species.	
Conclusion of assessment of significance	
There is a potential for a significant impact on a local population of the Booroolong Frog at Campbells River if the pipeline crossing is trenched at this location and if the frog is present. Directional drilling would avoid this habitat and is unlikely to result in a significant impact. Additional surveys are recommended to determine whether the species occurs at this location.	

GHD

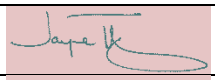
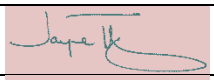
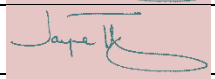
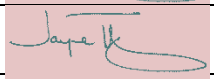
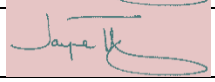
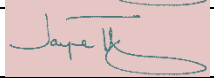
133 Castlereagh St Sydney NSW 2000

-

T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

n:\au\sydney\projects\21\21844\WP\185044.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	K. Crosby B. Harrington	J. Tipping		J. Tipping		18.12.12
1	K. Crosby B. Harrington	J. Tipping		J. Tipping		7.02.13
2	K. Crosby	J. Tipping		J. Tipping		7.03.13

BATHURST

GHD